THE MODEL ENGINEER

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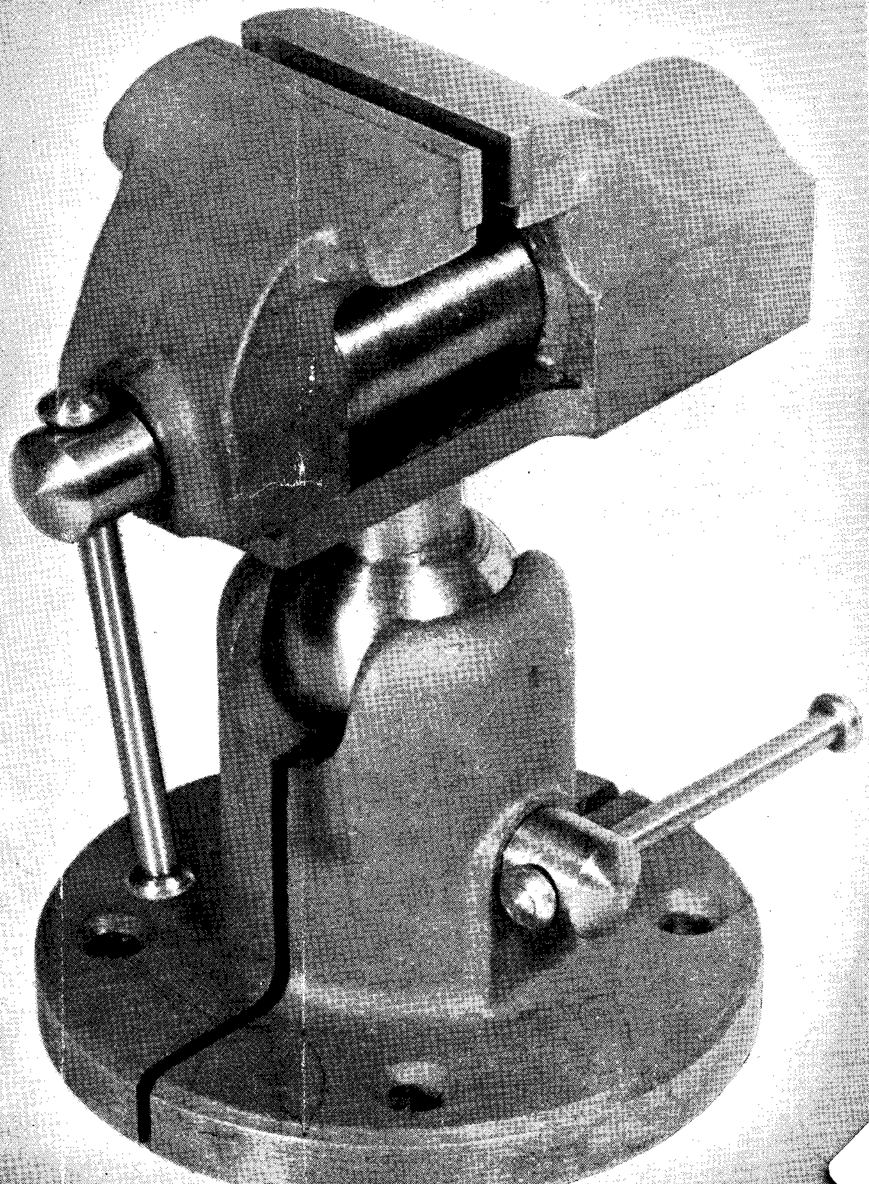

The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

14TH APRIL 1949 VOL. 100 NO. 2499

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SMOKE RINGS

"M.E." Exhibition Competitions

● THE VARIOUS classifications for models at the "M.E." Exhibition this year have been slightly modified and extended, in order to cover the widest possible range of interests as well as to keep pace with the latest developments in our hobby. There will be eight main sections, A to H inclusive, and each will be sub-divided into one or more classes according to the type of model to be classified.

Section A covers the Club Team Championship for Engineering Models and Section F covers a similar contest for Aircraft Models. In each case, the section is open to recognised clubs and societies for the best representation in the Competition Section by individual entries of their regular members. Each club should nominate three entries of any type or class for consideration.

The other sections will be much the same as in previous exhibitions ; but we hope to see many entries in Section E, which is for any type of model or mechanical work by a junior under the age of 17 by August 17th, 1949. Last year, this section proved to be a popular one and we believe it will be again.

A Kodak "Get-together"

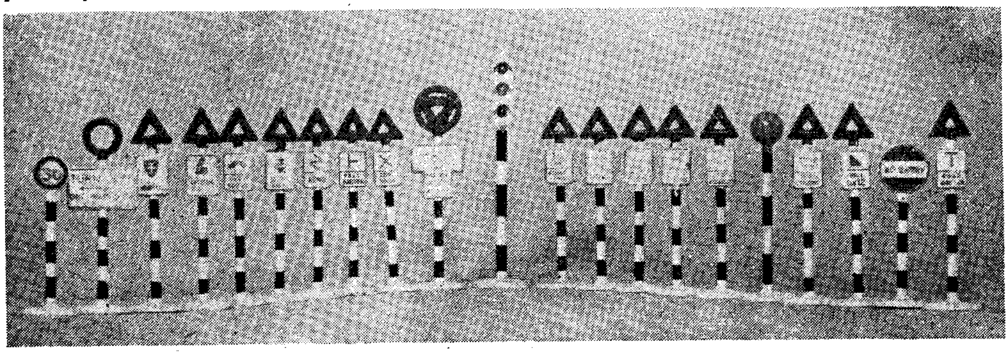
● ON SATURDAY afternoon, March 5th, the S.M.E.E. Affiliation had a social "get-together" at the Kodak Social Centre, Wealdstone. Quite appropriately, this event, the first of its kind, was organised by the Kodak Society of Experimental Engineers and Craftsmen, the first society to become affiliated. There was an excellent attendance representing some eighteen societies. The visitors were shown over the Kodak factory power house where they saw oil-fired and mechanically coal-fired Babcock boilers, geared pass-out turbo-generators, direct-coupled H.S. enclosed engines and dynamos (Bellis and Morcom and W. H. Allen), an exhaust steam turbo-generating set, direct steam-driven ammonia compressors and high-speed motor-driven enclosed ammonia compressors, besides a wide variety of ancillary plant and equipment.

The K.S.E.E. & C.'s workshops were also open for inspection and caused the members of many less fortunate societies to break the Tenth Commandment! An exhibition of models, tools, work in progress, drawings, pictures and photographs had been got together, and to this

were added some excellent exhibits brought by some of the visiting societies.

After and interval for refreshments, the party adjourned to the lecture hall where cine films and slides were shown, with suitable commentary, for about an hour. This concluded the formal proceedings, but for the next hour enthusiastic groups were doing just what the organisers had primarily in mind; *getting together.*

moored in the local park lake, where they were found by a police officer. One of the models had sunk, presumably as the result of a gale that was raging at the time. Examination revealed that all the models were intact but very dirty; evidently, the thieves came to the conclusion that any attempt to dispose of the models would be too dangerous, and decided to put them where they would be readily found.



A Motorist's Nightmare

● AT LEAST, that is what is suggested by the photograph on this page!

The collection of road-signs, however, consists of twenty-one 7-mm. scale miniatures produced by Lamedos Industries Ltd., of Eton. The firm informs us that, during the past twelve months, something like one million of these miniatures have been produced for distribution as toys and also for instructional purposes to the War Office and local authorities for use in "Safety First" campaigns.

We can think of other uses for these attractive little products. The scale of 7-mm. to the foot means that they are just the thing to add realism to a "O"-gauge model railway layout embodying scenery and roadways; they would make pleasing little mascots, and the home of a really enthusiastic motorist might be decorated by a few in each room! They are aluminium castings painted in the correct colours, and each is provided with a disc-base, enabling the model to stand firmly on a flat surface.

Repentant Thieves

● WE WERE shocked to receive a letter from Mr. Herbert H. Robson, hon. secretary of the Heaton and District Model Power Boat Club, to inform us that the club's headquarters were broken into, during a recent week-end, and all boats laid bare. Some thirty lockers were forced open; but it would seem that the thieves were after one particular class, for two 5-ft. 6 in. × 11-in. 30-c.c. water-cooled petrol craft, one hydroplane of quality and speed, and one steamer were stolen. The last-mentioned was covered with a black cloth, so the thieves probably mistook it for a petrol boat.

However, about a week later, we had another letter from Mr. Robson, to give us the good news that the stolen models had been returned, though in a somewhat novel manner. Apparently, under cover of darkness, the models had been

Exhibition at Chelmsford

● MR. D. T. WYATT, secretary of the Chelmsford Society of Model Engineers, informs us that his society and the Chelmsford Model Aircraft Club are organising an exhibition of "Engineering in Miniature," at the Shire Hall, on May 18th, 19th, 20th and 21st next. On the first day, the exhibition will open to the public at 3 p.m., but on the three subsequent days the doors open at 10 a.m.

This year, for the first time, there will be a competition for the East Anglia Challenge Cup presented by the Chelmsford S.M.E., and from our recollections of former exhibitions organised by that society, there will be some keen competition for the new trophy.

Models of all types and sizes, trade stands and other features will ensure that there will be something to interest any enthusiast.

Showmen's Engines

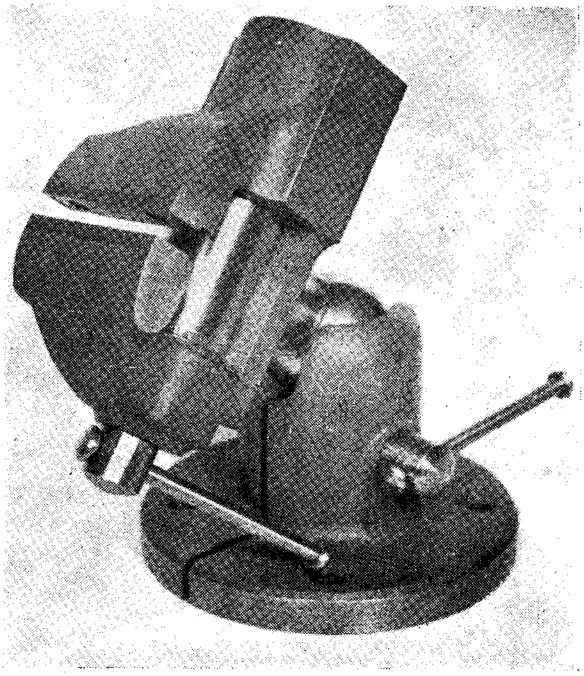
● THE NEWS that Miss S. Beach's Burrell engine, *King Edward VIII*, is being redecorated for use during the coming season has caused several readers to write asking if we can say where this engine is likely to be working during the summer. We are just as keen as any of our readers to obtain some definite information on this matter, and we are making enquiries in several directions; if we hear any news, we will publish it. It probably depends upon how many circuses are sent out and which routes they take; also, the question of the time-table to be operated must have some influence. Above all, the mechanical condition of the engine itself has to be taken into account; it may look very "spick and span," and might be capable of supplying the needs of a stationary circus for many years to come. But its *roadworthiness* could be quite another thing!

Incidentally, one reader, Mr. K. Birkby, of Sowerby Bridge, wants to know what has become of Mrs. A. Deakin's *Supreme*, a Fowler showman's engine, No. 20223, built in 1934; can any reader supply the information?

A Universal Swivelling Vice

by "Ned"

IT is a well-known fact that however well-equipped one's home workshop may be, there is always something extra needed to improve the scope or facility of the equipment, and the constructor of workshop appliances or "gadgets" is never at a loss for "something to make." Most of the appliances made by the amateur are in the nature of attachments and fixtures for machine tools; there is a tendency to take bench tools more or less for granted, at least in respect of design, and though many amateurs construct or adapt the simpler forms of tools, originality in the design of these devices is not very common.



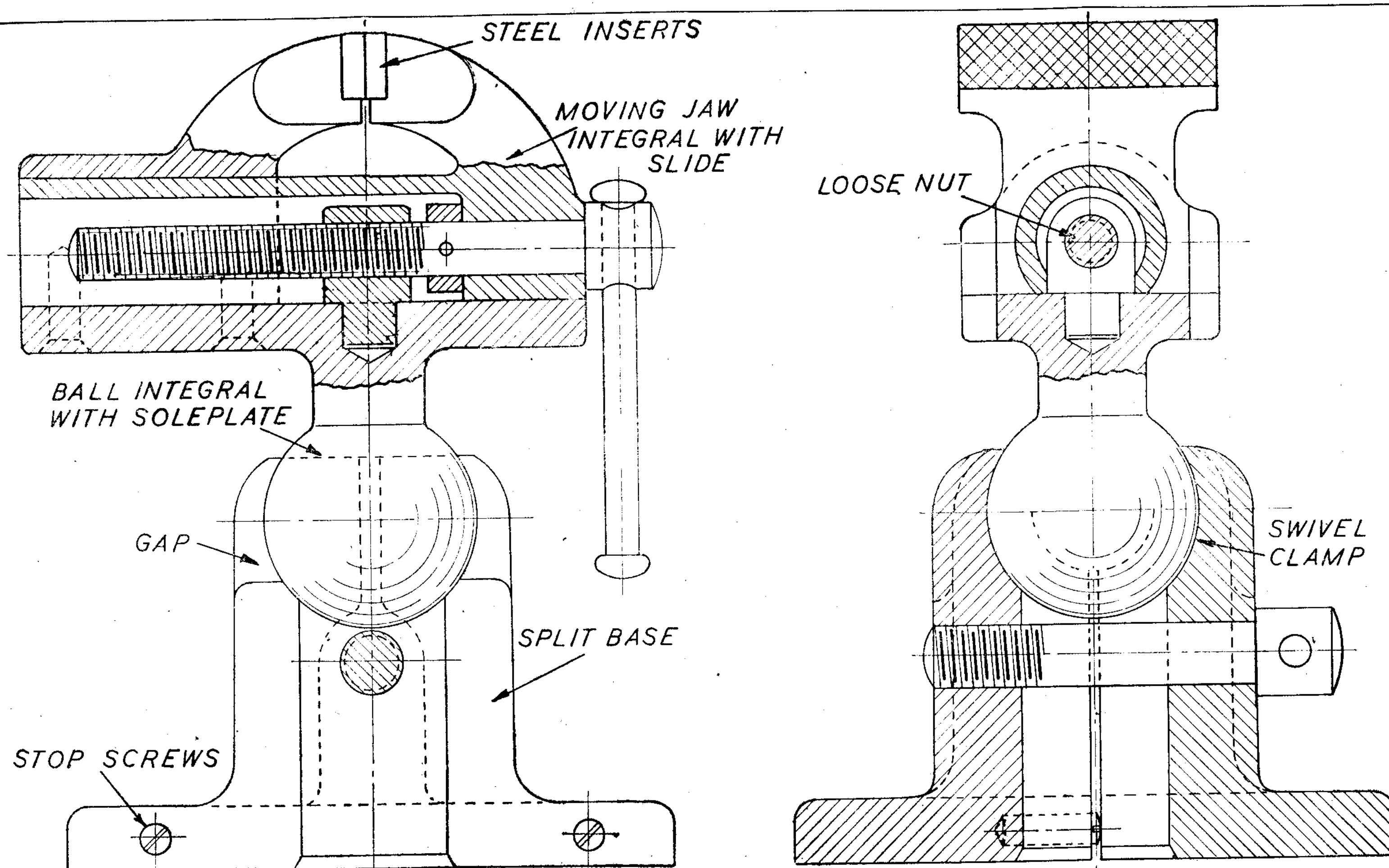
A view of the vice in the tilted position. Another view, showing the vertical position, is reproduced on the cover of this week's issue.

The bench vice is one of the most essential workshop appliances, and may be taken as a typical example of a device which has seen little change or improvement in the course of many years. So far as the engineering workshop is concerned, the old-fashioned "leg vice," with its radial jaw motion, has long been obsolete, having been superseded by the parallel vice, for reasons which will be obvious to anyone who has had cause to make a practical comparison of the two types. Many changes have been rung on the design of the parallel vice, but the standard form of design as exemplified by the products of the best-known manufacturers, has a basic soundness which is very difficult to improve upon. Most of the practical improvements which have been made in bench vices during recent years concern not so much the main design as means of handling work of awkward shape, or locating it to the best advantage; and this is true not only of bench vices, but also those used on machine tools. The most obvious improvement of this nature is the introduction of some form of swivel mounting which enables the vice, and the work held in it, to be swung bodily into the most convenient angle for the particular operation in hand, and locked firmly in that position.

The swivelling action may be of the simple type, providing a pivotal movement around an axis which is usually vertical, though it may be in other planes. But for the maximum facility, it is quite obvious that a universal swivelling movement in all planes, such as can be obtained by the use of a ball-socket joint, is called for. There are many examples of ball-mounted vices in commercial production and their advantages are beyond question, but most of them are very expensive as compared to vices with a non-articulated mounting, and, therefore, not readily available to the amateur.

It is, of course, quite possible to fit an ordinary vice to a ball-socket mounting, and this has been done with success in some cases, though the superimposition of plain and swivel mounts may become somewhat unwieldy. An ingenious method of mounting a vice on a ball joint obtained from the transmission shaft housing of an old Ford car was described in the "M.E." in January, 1935. But generally speaking, it is difficult to obtain a suitable ball-socket joint ready made, and the machining of components for such a fitting is generally considered to involve formidable problems for the amateur with limited equipment.

In the vice now to be described, the ball swivel, which is an integral part of the structure rather than a supplementary fitting, can be machined on any normal amateur's lathe, with the aid of a very simple and easily-made attachment. The vice is made in a size which is not intended to supplant the ordinary bench vice, but is an extremely handy supplement to it for dealing with those awkward little jobs which are so often a difficult problem to handle in the ordinary way.



General arrangement of the $1\frac{1}{2}''$ Universal Swivelling Vice. (Full size).

One often sees work of this nature either marred by attempts to grip it in a large vice, where the use of "clams" or soft pads is precluded by the small area of gripping surface available, or held rather inefficiently in a hand vice or a pair of pliers, leaving only one hand free for the manipulation of other tools. There can be few model engineers who have not, at some time or other, felt the urgent need for a readily accurate little vice which will hold small parts in any position; and this need is felt, whether one is working on small mechanical parts such as the links and die blocks of a locomotive valve-gear, or the pallets and levers of a clock, or on non-working components such as fittings for model ships or miniature railway equipment.

Sound Design

The size of the vice is not only convenient for such purposes as this, but is also well within the capacity of the machining facilities of the average amateur workshop. There is, however, no objection to increasing the dimensions if one wishes to do so, as the design of the vice is quite sound in any reasonable size, and it may even be made to double linear scale—that is, with jaws 3 in. wide, which would be large enough to take most of the normal work of the amateur workshop, while still delicate enough for handling quite small parts.

In the design of this vice, an attempt has been made to embody principles, not necessarily original in themselves, but not commonly applied to commercial production of bench vices, and capable of producing a degree of precision not usually associated with this form of tool. Moreover, what is more important from the point of view of the amateur constructor, the machining processes can all be carried out on the lathe, with the aid of only the simplest attachments or fixtures.

One might be tempted to call this a "precision" vice, but so much has this term been overworked and abused in recent years that it has almost ceased to signify anything; and in any case, it depends basically not upon the design but upon its execution. In other words, "precision" is what you make it; but one can at least say that any competent worker who carries out the work in the way described can produce, without much difficulty, a vice which has an accuracy and smoothness of motion comparable with that of a good machine tool.

General Construction

Referring to the general arrangement drawing, Fig. 1, it will be seen that the vice itself is of fairly normal or "conventional" design, at least in respect of the shape of the jaws and the disposition of the slide and screw, but the actual design of the slide is somewhat unorthodox, in that the sliding parts, instead of being square or prismatic, are part-cylindrical or roughly D-shaped. The main object of this, of course, is to facilitate machining, by turning the ram of the movable jaw, and boring the tunnel of the fixed jaw, prior to flattening the bottom surface of each component to fit on the flat top of the soleplate. It may be mentioned that the use of cylindrical or part-cylindrical slides in vices is by no means uncommon, but the particular method of producing the slides, adopted in the present case, is claimed to be original in detail. The ram of the movable jaw is hollow, and forms an enclosure for the vice screw, which affords complete protection from dirt and filings, while the nut, which is loosely fitted to a socket in the soleplate, is free to take up its own angular alignment with the screw, and is, of course, readily renewable if this should ever be necessary. All these features make for easy fitting and accessibility, without detracting from handiness and rigidity. It will be seen that under normal working conditions, the downward thrust on the front of the movable jaw is taken on a broad base which rests on the front of the soleplate. This support is not available at wide jaw openings, but for the class of work for which the vice is mainly intended, it is anticipated that it will not be much used under such conditions, and that most of the work will be done with the jaws fairly close together. No claim is made that the vice is stronger than any other of its size and weight, but it can at least be said that the material in it is so disposed as to afford good support to the stressed parts.

The Ball Swivel

It will be noted that the ball on which the vice is mounted is an integral part of the soleplate, and while some constructors may possibly prefer to make it a separate part, for real or imaginary ease of construction, it is claimed that, in conjunction with the other features of design, it is an advantage to make it in this way. In many ball and socket joints, the construction of the socket fitting makes it necessary to use a separate ball in order to allow of assembly. Such devices may have a concave seating in the base mounting, in which the ball rests, and is pulled down into firm contact with it by a concave cap screwed over the outside of the seating, or otherwise provided with means of clamping down. Alternatively, the mounting may be made hollow, and the ball inserted from below, seating in a concave neck at the top end of the mounting, and clamped by a concave pad which is pressed upwards by screw or cam action.

Both these methods enable the ball-socket assembly to be made extremely neat and compact, besides being rigid when secured, but they must necessarily restrict the range of angular movement of the ball, because it is necessary to carry the upper portion of the internal spherical gripping surface over the ball to a sufficient extent to provide an adequate strength to resist bursting force and prevent jamming. Moreover, the stalk of the ball must be made large enough to support the vice rigidly, and also to provide a means of attachment, which is often by screwing into the base of the vice or some form of union joint, both of which methods have apparent weaknesses.

Wide Angular Range

In the vice illustrated, the ball is gripped by the sides in a split mounting socket, provided with a base flange for attachment to the bench, an arrangement which is by no means so good in appearance as the methods specified above, but it provides a much wider angular range in one

(*Continued on page* 460)

An Inverted Vee-Block

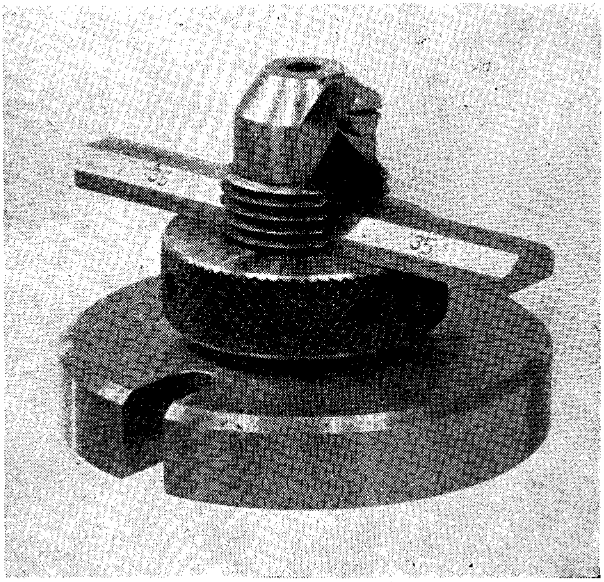
by Mats A. Hede (Sweden)

IN connection with the excellent article on the delicate problem of accurate cross-drilling of rods by " Duplex " recently, I think perhaps this little cross-drilling jig, which I have not seen described before, may be of interest to the readers of THE MODEL ENGINEER.

The photograph and drawing are self explanatory, so little need be said of the construction. It is intended for the smaller sizes of rods, but as these are not at all the easiest ones to drill and rather commonly used in model engineering, the jig will most probably come in handy many a time. It is very convenient to use and fairly accurate if used with discretion.

The actual size of the writer's vee-block is for a maximal diameter of 10 mm. ($\frac{3}{8}$ in.), but it can, of course, be made larger, if the other dimensions are increased in proportion.

It consists of a base with a slotted flange for clamping, a threaded and slotted column with the vee upside down in the top. A hole is drilled centrally in the top for the guide bushes. In the slot slides a support for the rod to be drilled, and is adjustable in height with a nut. The support is lightly pressed down against the nut by a screw with a spring in the bottom of the base. The support and the screw both have a central hole to receive the drills, when they are breaking through the rod.



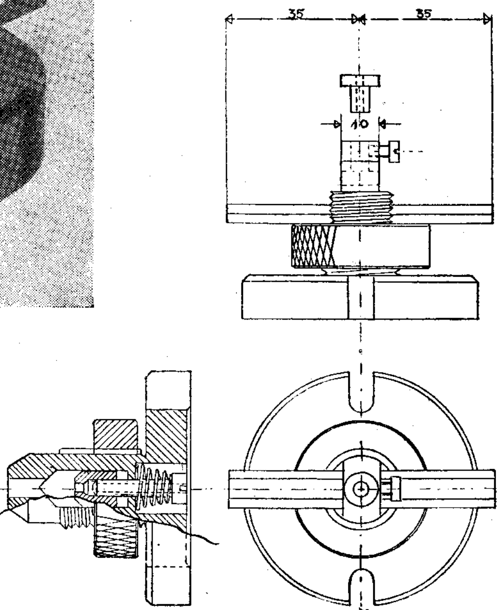
To ensure accuracy, the thread must be cut in the lathe, the upper surface of the nut must be dead square to the axis of the column and the upper and lower surfaces of the support must be scraped parallel. Last, but not least, the vee proper and the hole for the guide bushes must be exactly central.

The guide bushes are hardened and are only needed in a few standard sizes, as the jig is normally used only for drilling a pivot hole. It is easy to enlarge a hole, if the initial work is done well.

It is important to select the drills for the guide bushes carefully, so that the cutting edges are really true, and I myself use the drills selected only for the cross-drilling job. They are stored together with the bushes on a neat wooden block.

The two dimensions given on the drawing are used as reference for the exact location of the hole axially. Sometimes it is convenient to measure from the face of the column, sometimes from the edge of the support. The dimensions chosen should be simple, no odd sixty-fourths, and as exact as one can make them.

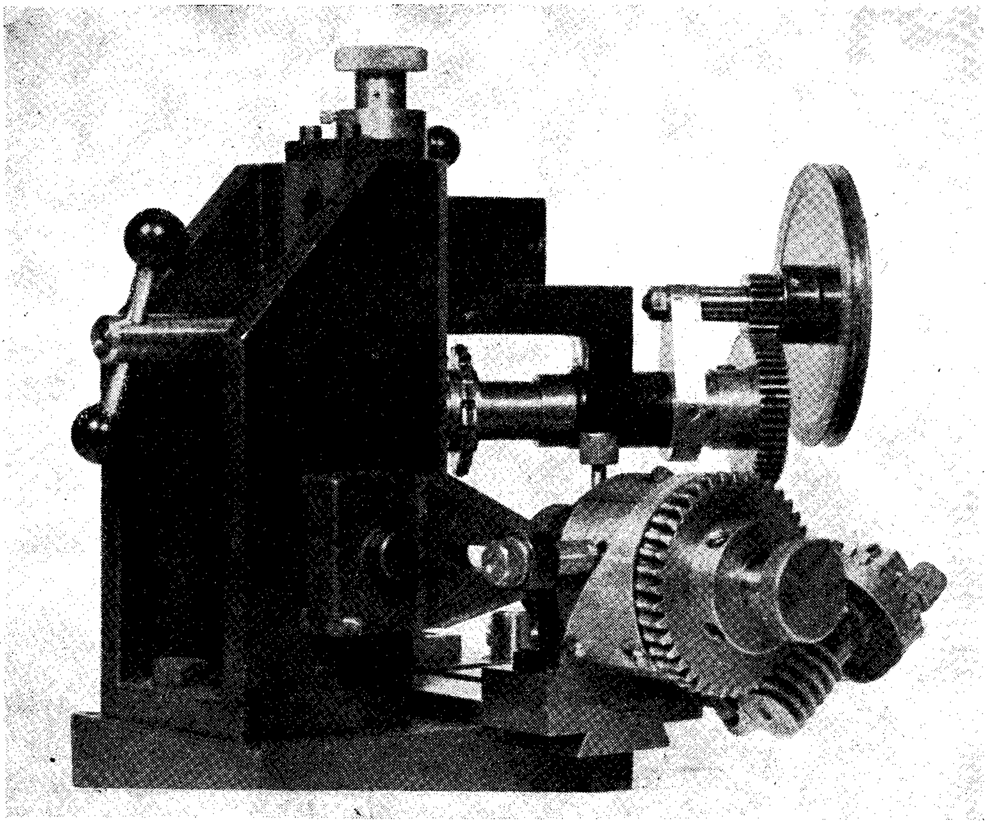
As an acid test for the finished jig, the following is recommended. Take two pieces silver-steel, say $\frac{1}{4}$ in. diameter × 1 in. long and $\frac{3}{8}$ in. diameter × $\frac{1}{2}$ in. long. Drill a cross-hole 3/32 in. diameter in the middle of each of the rods with the aid of the jig. Bore out the $\frac{3}{8}$ in. piece axially in the lathe to a sliding fit on the smaller one. If you can get the radial holes to coincide, however, you choose to combine the bush and the rod, the jig is all right—and the drilling technique, too !



Constructing a Gear-Cutting Machine

by J. S. Eley

SINCE the publication in February, 1947, of the description of a small gear-cutting machine, many enquiries have been received from readers who would like to build a similar machine for themselves, and so, at the Editor's request, the following notes and drawings are presented. in its present form is really suited for such small work, clock gears are well within its scope, and although gears down to $\frac{3}{16}$ in. diameter and even less can be cut, I would suggest that if the cutting of such small gears alone is contemplated, the general design could with advantage be



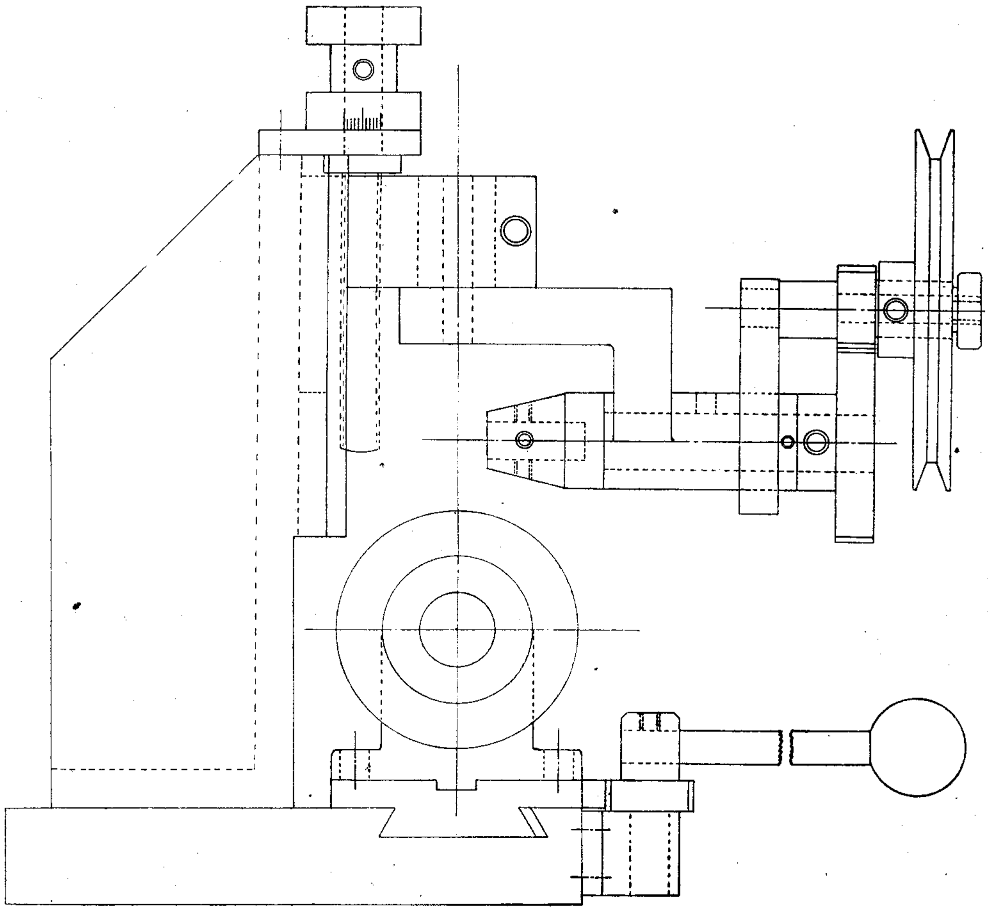
Rear view of the completed machine

The machine was entered in the tools section of the 1947 MODEL ENGINEER Exhibition and was awarded a silver medal. This unexpected success has been a big encouragement to me and has resulted in further correspondence, some from as far afield as Amsterdam and Johannesburg It has been interesting to note that quite a few of the enquiries have come from readers engaged in the watchmaking and repairing trade and it is obvious that a small universal gear cutting appliance would find many uses in that field. Although I would not suggest that the machine copied on a still smaller scale. This would considerably simplify its construction, first by bringing all the machining within the scope of the average small lathe and secondly, owing to the light nature of the work to be handled, by allowing parts to be fabricated instead of employing iron castings. Such a miniature machine would not, of course, need the speed reduction gear; in fact, the spindle speed could be increased with advantage, particularly if fly cutters were to be used.

In its present form, however, the machine

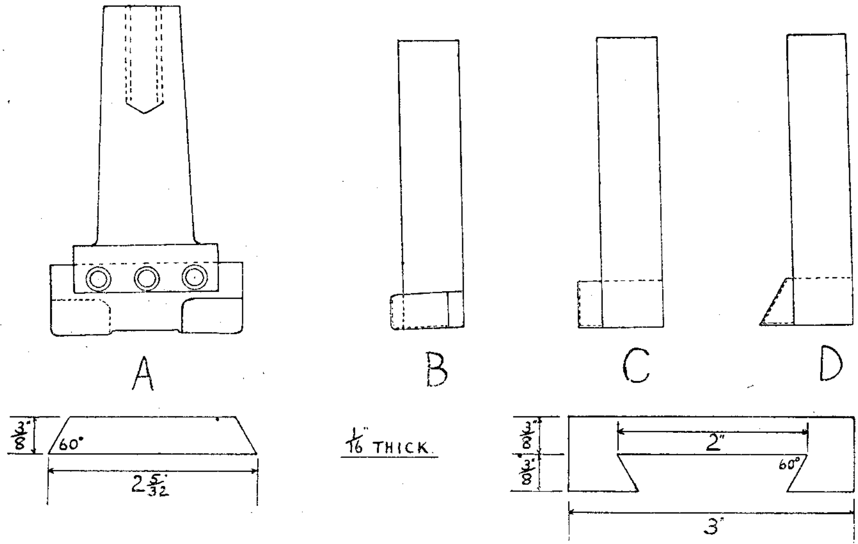
although small, is designed for and capable of handling comparatively hefty work. For example, its own speed-reduction gears were handled with a direct drive to the cutter, and they are 20 d.p. in steel and ½ in. face. I think a machine of such capacity will be more generally useful for model engineering purposes and so the constructional details will apply only to the machine in its present form. One big difficulty that faces the constructor these days is the supply of castings. I am pleased to say that I have been able to get a number of sets of castings for this machine cast from the original patterns, and should be glad to help any reader in this respect. One criticism that may be made against the machine is that it is of too specialised a nature to be worth while making up for the home workshop. I agree that a considerable amount of work is involved but it must be borne in mind that gears are not the only things requiring circular dividing. In addition to gear-cutting, the machine can be put to many uses including the following :

Circular engraving of index collars.
Cutting ratchet wheels and escapement wheels.
Fluting taps and reamers (Spirally if necessary).
Generating cams.
Cutting splines and keyways.
Cutting cinematograph sprockets.
Cutting petrol lighter wheels.
Certain types of circular milling.
Knurling that is beyond the capacity of a light lathe.



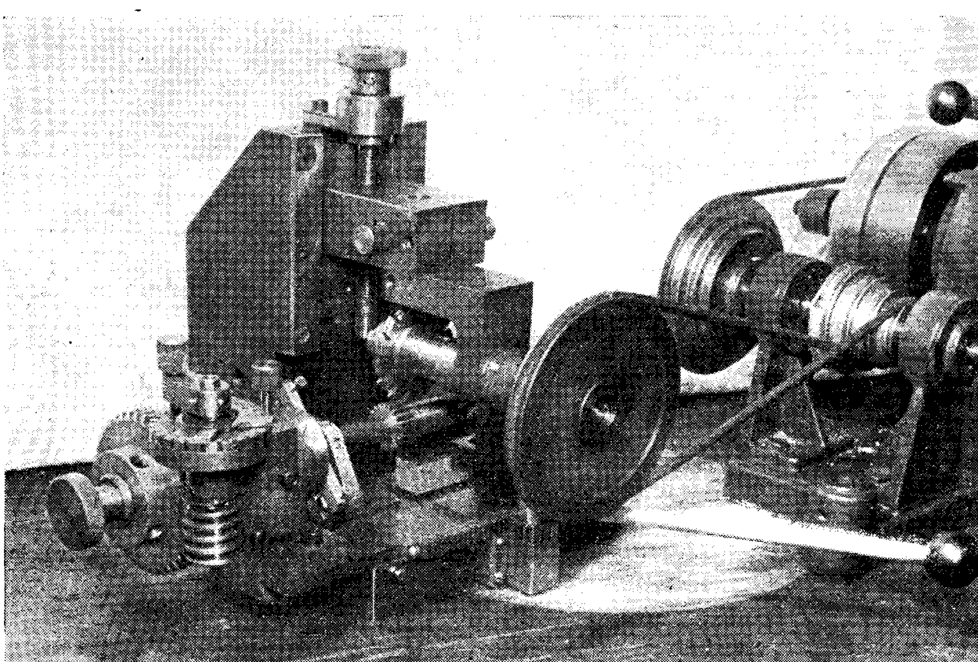
One further suggestion—if a milling machine is part of the workshop equipment the whole of the super-structure can be dispensed with and only the base, table and dividing heads made up for use on the milling machine. This combination will give all the features incorporated in the complete machine.

To ensure maximum rigidity, iron castings are used wherever possible, and although this method presents some problems in machining it is well worth while. All the machining of flat surfaces was done by fly-cutting or end-milling using home made cutters. These are of very simple construction and are easily made up in the home workshop. Sketches of various types of these cutters are given. " A " is a type with two cutting edges and is most efficient, under good



Internal template. *External template*

conditions being capable of producing a surface on cast iron comparable to that produced by grinding. It consists merely of a short length of rectangular steel bar, with a recess milled or chipped in each end to take the cutter bits. These recesses of course, must be one on either side of the bar to suit the direction of rotation. The cutter bits are secured in their seatings by brazing or silver soldering. The cutter bits themselves are best of tungsten carbide as they are then able much more easily to get under the hard skin of the cast-iron and of course, require

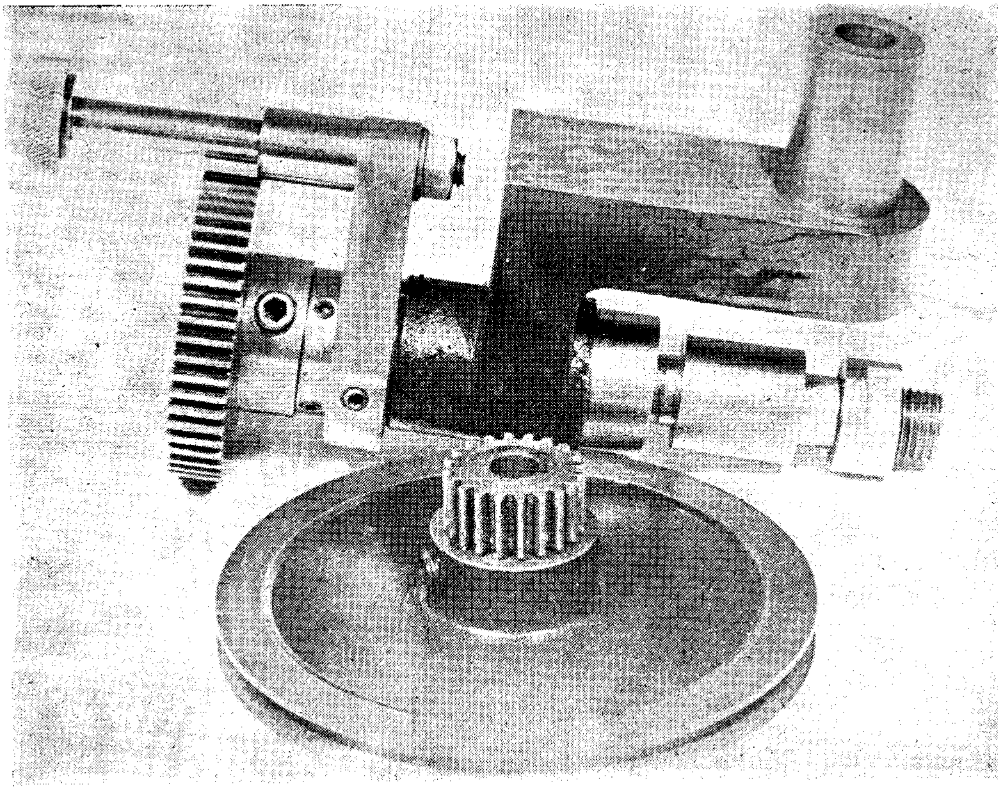


Cutting the speed reduction gears on the partly completed machine

sharpening less frequently. High speed steel can be used, however, but there is a little bit of technique necessary in the brazing operation. Tungsten carbide is not affected by moderate brazing temperatures but generally speaking, high-speed steel will soften a little if heated to brazing temperature and allowed to cool without

jecting piece to support it. This looks rather a crude piece of work and has a pronounced wobble when running but it is quickly made and gives excellent results.

For producing a sharp internal corner, we shall need a cutter as shown at "C." The cutter bit in this case is a piece of parting tool steel



Swinging arm and cutter-spindle assembly

quenching. On the other hand it is difficult to quench a brazed joint at brazing temperature owing to the fluidity of the spelter. A compromise has thus to be made and if the work is quenched as soon as the molten spelter is seen to set, the high-speed steel will not suffer much from the operation. The cutter bar is shown in a type of holder suitable for a lathe or milling machine spindle nose, the shank being tapered to suit. The holder should of course, be held firmly in place by a draw-bar through the machine spindle.

The double ended type of cutter is capable of extremely heavy work and if allowed to take the full width of cut of which it is capable, requires a sturdy machine. A type more suitable for light machines is shown at "B." This is really a single toothed end-mill. The end of a short length of round mild steel is cut away for a little more than half its diameter, and a cutter bit brazed in such a position that it projects a little beyond the surface of the shank. Again tungsten carbide is to be preferred and a generous filter of spelter should be left behind the pro-

$\frac{1}{8}$ in. $\times$ $\frac{1}{2}$ in., brazed into a slot cut in the end of a short length of round bar. As high speed steel is being used, it can project a little further than the tungsten carbide without support. Lastly, a cutter for forming the dovetail slides is needed as shown at "D" This is exactly like the preceding cutter except that it is ground away to a 60 deg. angle. This simply made cutter is all that is needed and will do the job quite as well as the expensive cutters with multiple cutting edges sold for this purpose and is moreover easy to sharpen. The last three cutters are designed to be gripped in a chuck but could be made with a taper shank if desired. All, of course, must have their cutting edges backed off.

As regards workshop equipment, a milling machine is a big advantage. To do all the milling on a lathe, would require one of at least 5 in. centre height with an ample cross traverse. However, the old adage "Where there's a will there's a way" was never more apt than when applied to model engineering.

(*To be continued*)

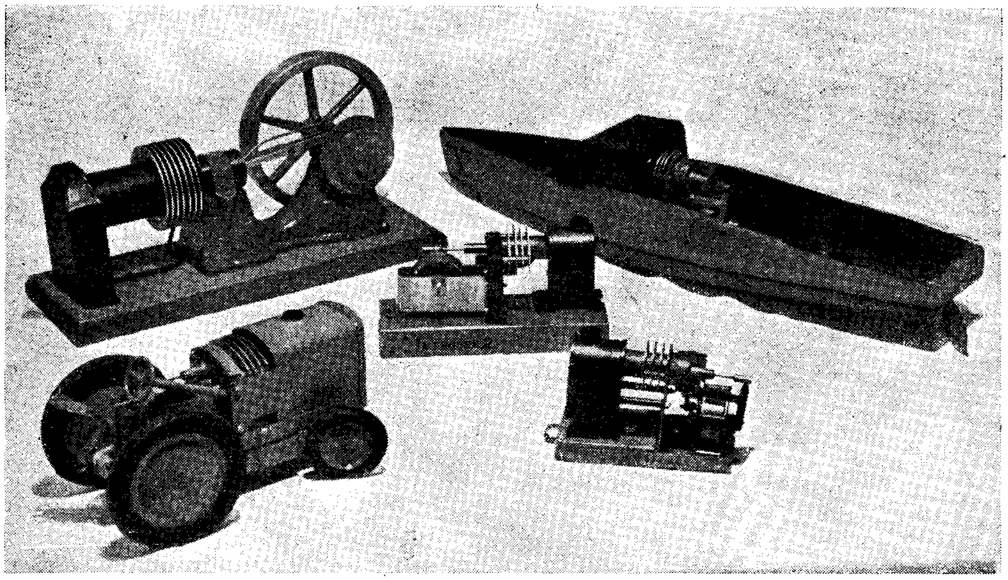
INTRUDERS

An introduction to successful hot-air engines

by R. T. A. Brown A.M.Inst.B.E.

PRESUMABLY all readers interested in this type of prime mover are aware of the advancements made abroad, particularly in Holland, during the past eleven years and will join me in congratulating all concerned.

The difference between the theoretical and practical performances of hot-air engines attracted my attention in 1932, and my den has been used almost exclusively since for the purpose of experiments designed to assist in the evolution and construction of efficient powerful units; and though unable to claim any great achievements, some knowledge has been gained.



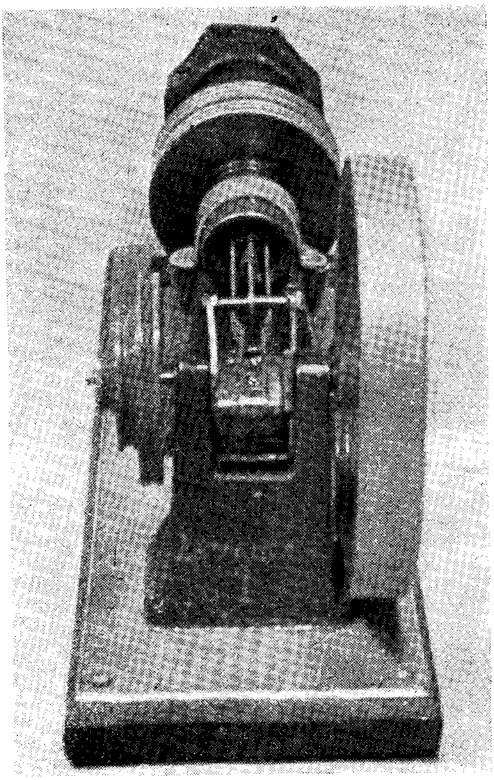
Some of the author's models. The hull is powered by a unit of $\frac{5}{8}$ in. bore and stroke, which prope it at 2 to 3 knots for $1\frac{1}{2}$ hours on one filling of the lamp

Few would expect to design and construct a successful internal combustion engine merely because they understood the two- or four-stroke principle, yet that is, more or less, what constructors of hot-air engines have been forced to do, because, apart from the well-known principle, very little reliable data has been available and that is probably why so many dissappointing engines have been constructed, for the application of the very simple principle does, in fact, present many problems of widely differing character.

Since my letter on the subject appeared in the "Practical Letters" in the January 6th, 1949, issue, I have received many communications and I have been privileged to inspect some very fine models, though alas, poor engines, and the purpose of this article is to reply to the many queries received and to provide all readers with hints and tips that will enable them to design and construct small, simple engines of the size and type in which they are chiefly interested, in the sure knowledge that when completed, good continuous runners will result.

The main interest appears to be in the simple closed cycle type having displacer cylinders 2 in. or less in diameter and, as such engines are quite capable of driving Meccano and similar models and will completely satisfy the desires of our young associates for clean, safe, prime movers which are ready to run at short notice for prolonged periods and possessing mechanical appeal, I propose to confine my remarks to them.

From correspondence received, engines examined and various reports I have read concerning readers' engines, one fact, at least, is certain. Engines are unnecessarily complicated. It seems many were simple as originally made, but, because of their inability to run continuously or



End view, showing mechanical details, including the reverse

lack of power, modifications in various ways were made until, in quite a few cases, they became so elaborate as to almost defy the application of reason in locating their real trouble. There are many who doubt that a simple engine will run, but I have several in my possession that do, and I believe that if an engine refuses to run in its simple form, there is something fundamentally wrong which should be rectified by simple means.

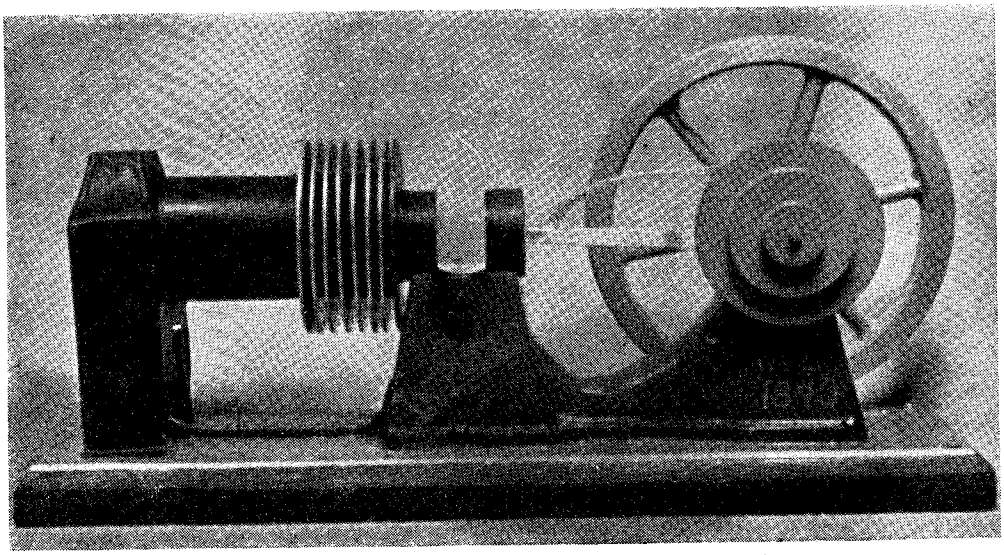
Mechanically it is essential that all parts work quite freely, and slightly sloppy fits are much better than any confliction. Preference should be given to cranks rather than eccentrics for displacer piston operation.

No Shake

The power cylinder must have a true bore and the piston, though absolutely free within it, must have no perceptible shake and should be provided with oil grooves which it is beneficial to fill with vaseline when finally assembling to the cylinder. Packing the pistons, as is common with small steam jobs, is not satisfactory and should not be resorted to. Piston rings can be employed, provided they bear extremely lightly against the cylinder walls, but there is no doubt lapping or honing of both components produces the ideal fit.

An engine with an ill-fitted piston will have little or no driving ability, and though it may run at high revolutions it will probably stall if these are reduced, whereas, if the parts fit well, an engine will pull harder as the revolutions decrease.

The displacer rod also must fit its bearing freely but without shake, and a good or bad fit will affect the performance exactly as will the fit of the power piston and cylinder. A D-bit will be



A simple hot-air engine of $1\frac{1}{4}$-in. bore and stroke

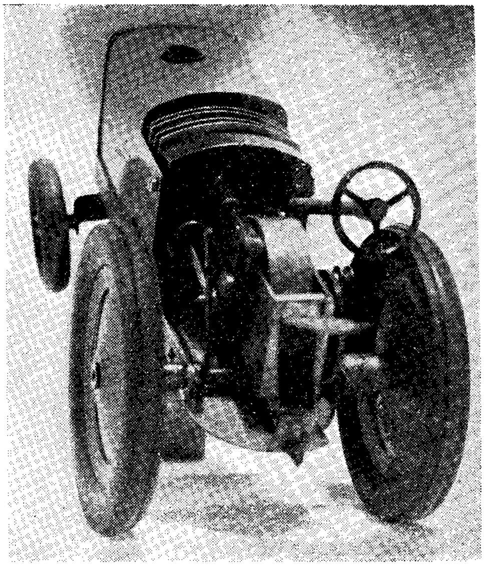
found useful for making the displacer-rod bearing which should be seven or eight times as long as the diameter of the displacer-rod. The latter should be as small as possible consistent with strength, as it is a necessary evil and tends to reduce the difference in working pressures.

The displacer piston is required to be as light as possible and should be made of thin material reinforced where it is attached to the rod. In simple engines, such as these notes refer to, pressures of more than 4 lb. per sq. in. are rare indeed, and the displacer piston can therefore be of really thin section. Whilst domed ends decrease air resistance and increase maximum speed, they do not influence power to any large extent and it seems they are hardly worth the extra work involved to make them. Soft solder is quite useless for making joints on this component, but silver-solder is suitable. The piston must be completely sealed and immersion in hot water is a good test, but care should be taken to clean off all flux before testing, as it has a nasty habit of temporarily sealing a bad joint.

Avoid Leaks

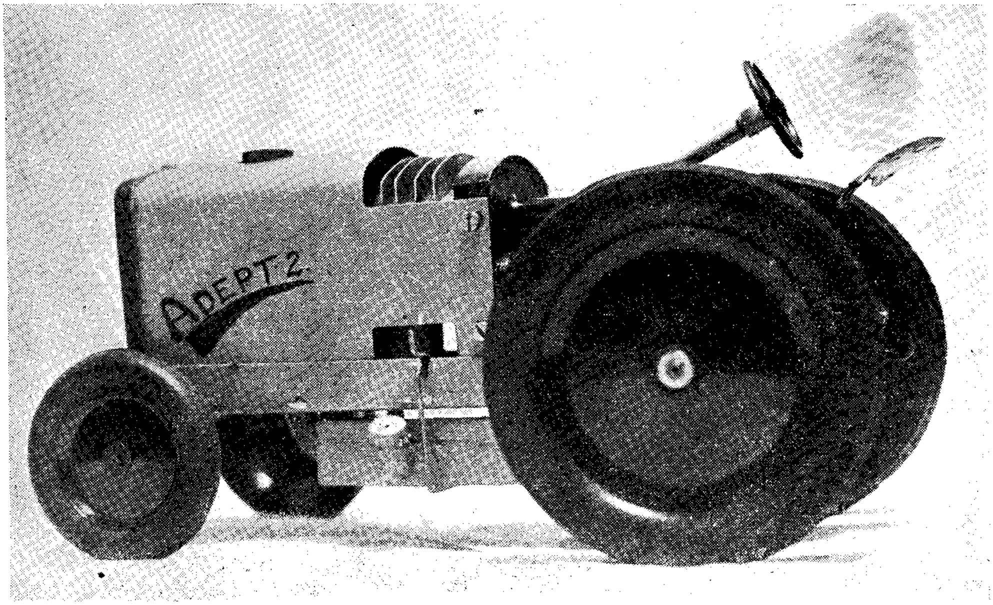
A leaky displacer will affect an engine in a manner similar to a poor fitting power piston, but the power will fall off gradually as speed is reduced. Of course, if leakage is very bad, the engine will not run. Whilst lightness is desirable, this is purely for mechanical reasons and engines will run using solid pistons. Even a chunk of hardwood can be pressed into service, and I have used solid dural for very small capacity engines.

The biggest single cause of trouble with hot-air engines is undoubtedly the displacer cylinder and an explanation of its functions will not be amiss.



The model tractor, which gives $1\frac{1}{2}$ hours running on a lampful of methylated, and will climb a 1 in 4 gradient

The end at the heat source should permit heat to travel quickly from its exterior to the air within and the cooled end should extract residual heat from the air within, and enable it to be transmitted quickly to the cooling system. For these two purposes brass tube is quite suitable, but any heat conducted by the tube from hot to



Hot-air powered tractor, capable of hauling 20 lb. The unit is $\frac{5}{8}$-in. bore and stroke

cold end is wasted energy and must be kept to a minimum. For our purpose it is not necessary to employ asbestos washers or other means of heat insulation, which may well cause leaks to atmosphere. It is far better to compromise and a steel cylinder will give good results. Agreed, brass can be used but more heat will be required for equivalent power and more difficulty will be experienced in obtaining satisfactory cooling, than if steel is employed.

The hot chamber can be a very simple affair, somewhat similar to those employed by steam engines but the cylinder should fit well where it enters to prevent hot air wandering in the wrong direction. Some small amount of trial and error may be required to find the best amount of heating surface to expose to the flame.

Air Cooling

I strongly recommend the use of air cooling since all heat dissipated is energy wasted. It is far simpler to make and is quite adequate. Of course, a blazing inferno at one end of the displacer cylinder and a super cooling system at the other would increase power, but efficiency would suffer and running costs would be heavy.

When really powerful units are required, regeneration must be employed together with pressurisation, but as this does not appear to concern readers at present, I propose to omit any explanation.

A light, large diameter flywheel is, of course, preferable to a small heavy one, and a driving pulley having several steps is almost essential.

Idle air space should be kept to an absolute minimum, as its action is rather like that of a shock absorber, and which, by lessening the pressure differences within the system, reduces power. When the arrangement of the power and displacer cylinders necessitates their being connected by a tube, it is wise to make it of such size as will easily pass the quantity of air. Here, err on large size, as this tube, if small, will choke and smooth out pressure differences considerably even to the extent of upsetting timing, which should be such that the displacer piston moves 90 deg. in advance of the power piston. The connecting tube should always be as short as possible in order to keep the idle air space to a minimum.

Intruder I

The following are some details of an engine designed and constructed as an application of the foregoing observations. From many in my possession Intruder I is selected because she can be constructed with a minimum of equipment, cost, time and skill and, though much depends upon the workmanship, will not fail to run when completed.

Intruder I has a power-bore and stroke of $1\frac{1}{4}$ in. which is also the stroke of the displacer piston. The inside diameter of the latter is 1 51/64 in. and the outside diameter is 1 27/32 in. It is mild-steel throughout, 3 in. long overall and sealed at one end with a disc 1/32 in. thick, and at the other a disc $\frac{1}{16}$ in. thick to which the $\frac{1}{8}$ in. diameter silver-steel displacer-rod is attached.

The displacer cylinder, also of mild-steel, is bored 1 61/64 in., is 2 in. outside diameter and measures $4\frac{5}{8}$ in. overall. One end is sealed with a 1/32 in. disc, the other is screwed internally at $1\frac{7}{8}$ in. $\times$ 40 t.p.i. This thread fits a steel adaptor which is also threaded internally at $1\frac{3}{8}$ in. $\times$ 40 t.p.i. to fit the mild-steel power cylinder.

A brass power-piston carries the displacer-rod bearing which measures 1 in. overall and is made in cast-iron.

Heating

Heating was originally by means of a single-plain wick methylated lamp, and power was greater than I have known any steam engine to supply from a similar heater. She is now gas-fired with a small burner, marked Bray-England—No. 4, and is almost impossible to stop by gripping her $\frac{3}{16}$ in. diameter mainshaft between finger and thumb. A simple reverse mechanism is fitted, and continuous running, in either direction of rotation, at maximum power is available, provided lubrication is attended to. Medium engine oil seems very satisfactory, as the power cylinder remains comparatively cool; in fact, it never gets too hot to hold.

Cooling is by dural fins which are shrunk on to the displacer cylinder. Three aluminium castings are employed, one for the 6 in. diameter flywheel, one for the stepped pulley and the third is the bed. The base is a piece of $\frac{3}{4}$ in. thick wood protected by a covering of dural sheet $\frac{1}{16}$ in. thick.

Mechanical details need no description, for a glance at the photograph will make them clear to all. Engines down to half the size of Intruder I will run successfully if the dimensions given for the diameters of the displacer and power components are simply scaled down but displacer cylinders should not be less than $3\frac{1}{4}$ in. in length, or trouble, caused by excessive heat conduction, will be encountered.

Any who contemplate their first attempt to construct a hot-air engine would be well advised to model Intruder I to the full-size dimensions, for by so doing they will be certain of success and their interest will be stimulated. I have patterns, can get castings made quickly if any readers require them, and will gladly furnish more details if requested.

A Simple Engine

Now, if I may digress for a moment, a hint to the experimental minded who could do far worse than to make Intruder I as a means of getting a live start. Whatever you aim to make eventually, commence with a simple engine and get it running as such. Modify stage by stage and test the engine after each alteration before making further changes; for by so doing, troubles can be found and eliminated as they occur and a thorough understanding of the subject will be gained.

I sincerely hope that readers will obtain assistance from my notes and, though personally my primary interest is the development of engines for commercial purposes, I shall welcome correspondence concerning any size and type of the most fascinating of all prime movers.

SUPERSTRUCTURES

for "Maid of Kent" and "Minx"

by "L.B.S.C."

NOW that the excitement is all over, and you've seen for yourselves how the locomotives behave on the road—hope you were satisfied!—there is a rather humdrum job ahead in the shape of the sheet-metal work; but it has to be tackled if the engines are to look like their full-size relations. However, there is nothing difficult about it. Some of the followers of these notes have complained, in the past, that your humble servant hasn't devoted so much time to explaining how to do the platework, in detail, as he has given to the "how-and-why" of the working parts; but there is really nothing to dilate on! The following "'ints and tipses" should enable anybody of average skill and intelligence, to make quite a good job of what is usually known as the "top works and trimmings," of both the "Maid of Kent" and the "Minx." I might mention here, that it would be a distinct advantage to beginners, or inexperienced workers, if they obtained the full-size blueprints from our advertisers, and saved themselves the trouble or marking out to measurements. All they would have to do, would be to make a tracing of the cab sides, splashers, and so on; stick the tracing on the sheet-metal, and cut to outline, same as a kiddy sticks his fretwork pattern on his bit of thin wood, and cuts it out. The weeny amount of paper shrinkage can easily be allowed for, but on an engine this size, it doesn't matter a bean if it isn't, as the very slight discrepancy is certainly not appreciable to the naked eye when contemplating the finished engine. The blueprint could also be laid on a sheet of paper, with a carbon copying sheet between, and if a stylus or a blunt scriber is run over the white lines, same will be transferred to the paper by the carbon, making a paper pattern with very-easily-followed lines. My old friend the late and lamented Driver Bill Irvin was very great on doing his sheet-metal work by aid of stuck-on patterns. In this way you would be only really using a paper jig—and jigs are indispensable adjuncts to modern methods of mass production.

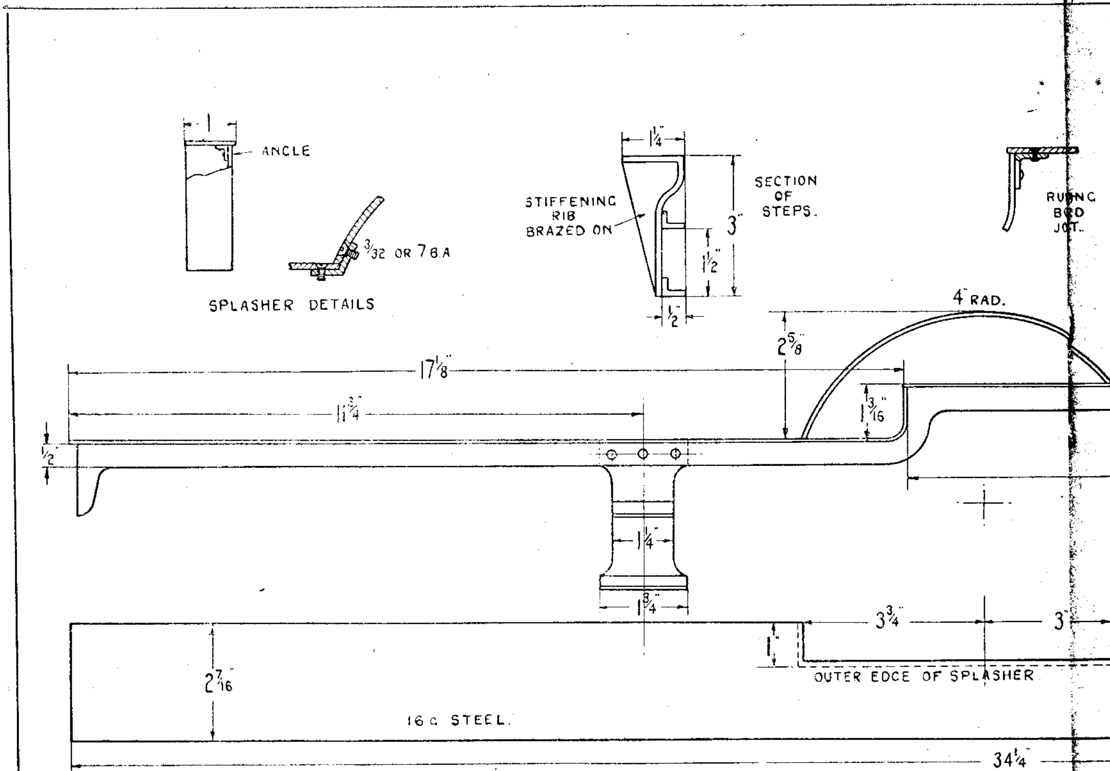
Running-Boards or Side Platforms

The running-boards of both engines can be made of 16-gauge steel plate, strips $2\frac{7}{16}$ in. wide being needed. The easiest way to make up the boards for the "Maid," would be in three pieces; the first, from the buffer-beam to the top of the first upward bend; the second, a straight piece 14 in. long, above the coupling-rods; and the third, from the rear end of No. 2, to the drag-beam. The joints could be made by pieces of angle, say $\frac{3}{8}$ in. by $\frac{1}{16}$ in., bent from odd bits of sheet, and riveted to both sections of running-board being joined; or they could be brazed together. My own plan would be to get the merry old "Alda" oxy-acetylene blowpipe on the job, with the 100-litre tip in it; and a spot of Sifbronze would make a sound and unbreakable joint at each place jolly nearly as quick as I can write these words.

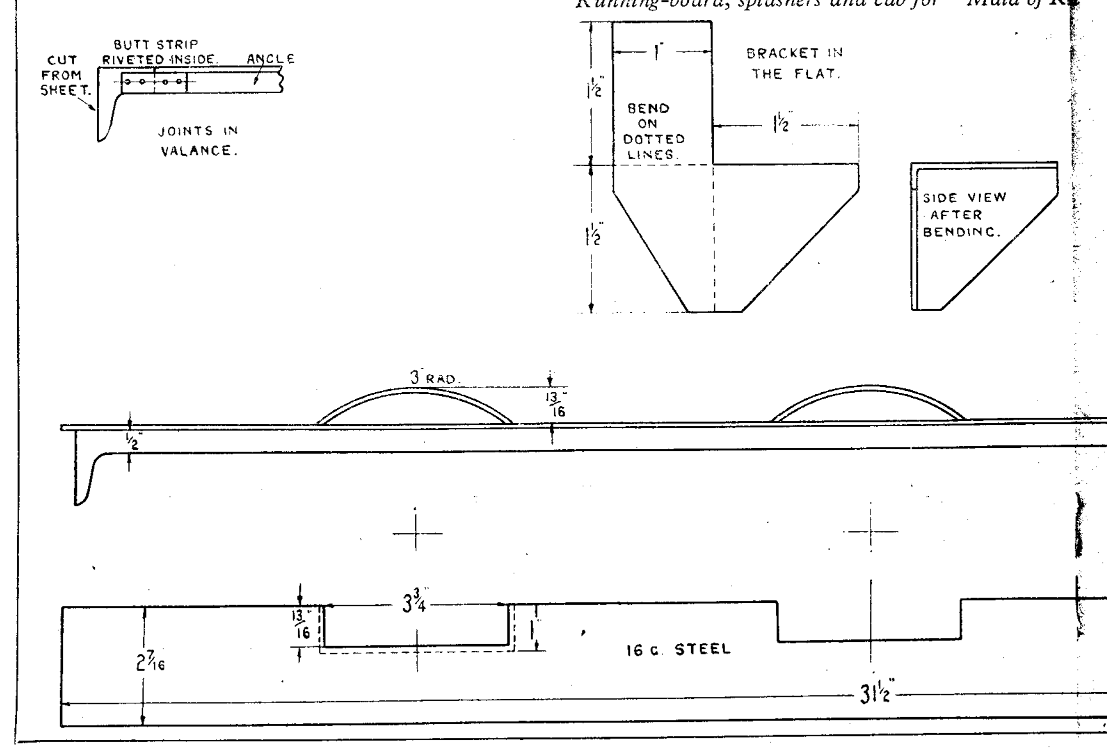
Maybe our advertisers will be able to supply the 16-gauge steel strips sheared to correct width, and in that case you are in the clover, because it only needs trimming to length, and the cut edge smoothing with a file, on the outside. Doesn't matter about the edge next the frame. Mark out the pieces that have to be cut away to clear the coupled wheels; clamp in bench vice with the marked line just showing at the jaws; saw down the vertical lines. Then apply the edge of a small cold chisel slantwise to the metal, "'it the uvver end wiv an 'ammer," as our 'Oxton friend Bert Smiff would remark, and trim up the raggedness with a file. Beginners who cannot obtain strips cut to width, will have to use a saw, pressing the vice top into service as a guide, and putting the sawblade sideways in the frame. A fine-toothed blade should be used; and when cutting, keep the blade pressed well down on top of the vice jaws, lubricating it with the same kind of cutting oil used for turning steel. The saw-marks are easily removed with a file.

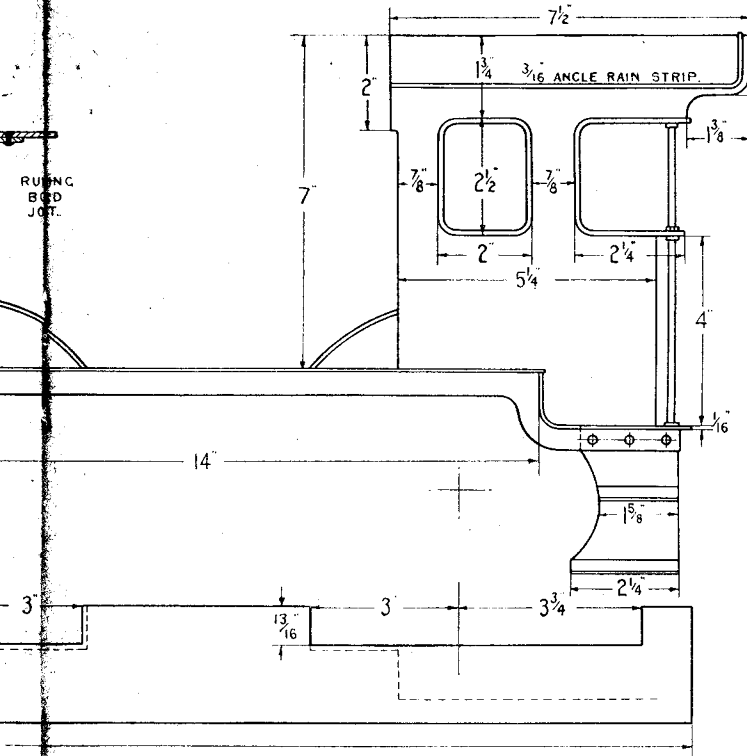
Of course, if you are lucky enough to own a small bench shearing machine, the cutting-o t part is just "a piece of cake"; but it would be an awful strain on even a strong man's wrist, to cut 16-gauge sheet steel with ordinary hand snips. All my own metal shearing, including boiler plates, has been done for the last 29 years, on a lever bench shear with 6-in. blades, which I bought cheap after the Kaiser's war; but just recently, good fortune has come my way. The President of the O'Neil-Irwin Manufacturing Company, of Lake City, Minnesota, U.S.A., is an ardent follower of these notes, and is building a $3\frac{1}{2}$-in. gauge locomotive. This firm produces the well-known "Diacro" precision machines for cutting, bending and shaping tubes, rods, and sheet-metal; and to help me in my own bit of locomotive building, Mr. O'Neil is presenting me with a 12-in. precision guillotine-type shearing machine, and a bending brake of same capacity, which will form angles and bends of every conceivable shape, including radius bends. Am I thankful?—well, I ask you! Incidentally, I stirred up the Import Licence Dept. of the Board of Trade; gave them a column of live steam all to themselves, and got my import licence in *three days*, which I should think constitutes a record! But it seems plumb crazy to me, to have to fill out forms to accept a gift from a friend.

Returning to the job, the running-boards for the "Minx" are merely straight strips, requiring no jointing whatever; see plan view. The



Running-board, splashers and cab for "Maid of K





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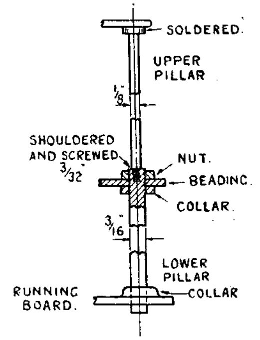
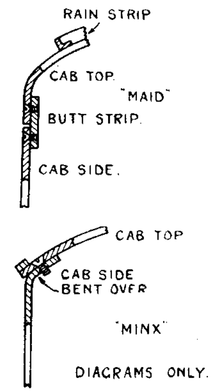
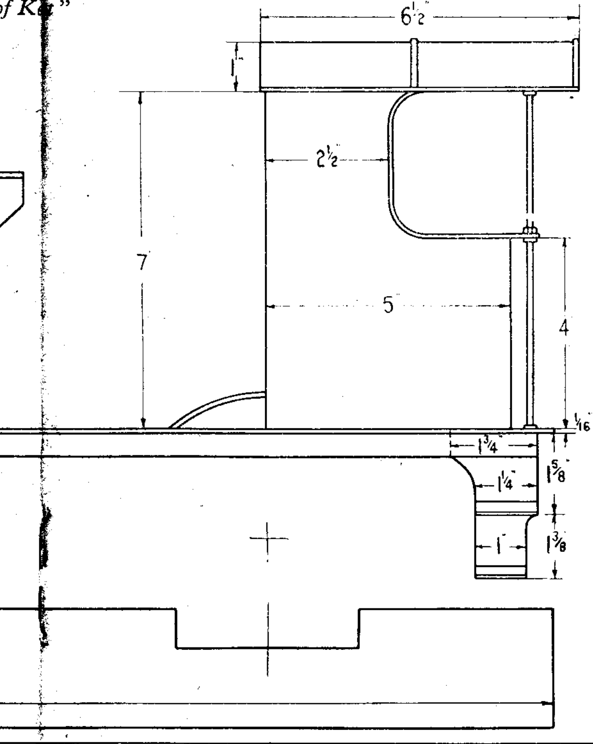
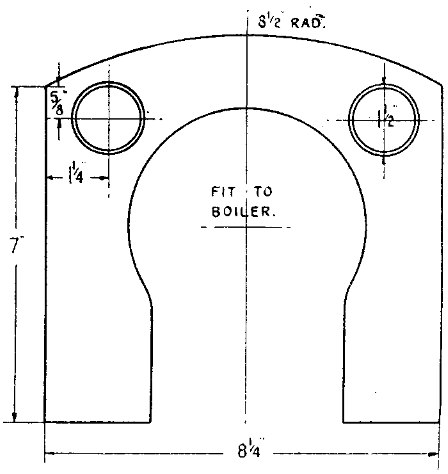


Cab pillars



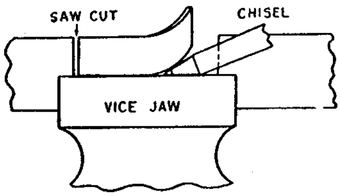
How to fix cab roofs





Running-board, splashers, cab and cab front for "Minx"

valances on both engines are ½ in. deep; ½-in. steel or brass angle can be used on the straight runs, and the curved parts under the ends of the raised portion of the "Maid's" running-board, also the fancy bits at the end next the buffer beam, can be cut from 16-gauge sheet-metal, butted up to the straight portions, and either brazed or Sifbronzed, or attached by a riveted-on butt strip at the back. The whole complete valance is riveted to the underside of the running-board by $\frac{1}{16}$-in. rivets. Those good folk who love to see lots and lots of rivet-heads sticking out all over a locomotive, can let themselves go here; but we should have



How to cut wheel clearances

blessed(?) them on the old "Brighton." Both old Billy and his successor Bob, used countersunk rivets, and provided us with an absolutely smooth "gangway" all around the engines, on which one could walk with perfect safety, even when the engine was running.

Splashers and Steps

The splashers and steps should be attached permanently to the running-boards before they are erected on the engine "for keeps," so that the whole issue can be removed as a single unit each side, in case of emergency. The sides of the splashers can be cut from sheet-metal, which need not be as thick as the running-boards; 18-gauge would be amply strong, and 20-gauge quite serviceable. Even that would be thicker than the steel plating used on the full-size Southern "Q1's" and "spam cans," which is 22-gauge only. The tops of the splashers are bent from strips 1 in. wide, and may be either attached by angles, as shown in the small detail illustration, or by brazing or Sifbronzing. Soldering would do at a pinch, but would not be very strong. Personally, I should use brass strip for the splasher tops of the "Maid," silver-solder it to the side plates, and polish up the brass edges, like the old Wainwright engines of S.E. & C.R. days.

The little splashers of the "Minx" can be made up in the same way, the dimensions being given in the drawing. The splashers of both engines can be attached either by pieces of angle, or brazing or Sifbronzing. In the former case, the angle is bent up from 16-gauge sheet, to suit the curve of the splasher, as shown in the small detail illustration; and it may be attached either with countersunk screws, as shown, or by $\frac{1}{16}$-in. rivets, just as you prefer. I should simply clamp each splasher temporarily in position, and run my blowpipe flame along the joint between splasher and running-board, with a taste of Sifbronze, same as I did when I built "Maisie." This is a jolly sight easier than soft-soldering, as you've no soldering iron to heat, and it doesn't matter about cleaning the metal. I Sifbronzed a patch on a rusty-bottomed coal pail without the slightest attempt at cleaning it, and the metal amalgamated perfectly. Great stuff, this Sifbronze!

The steps are also made up from sheet-metal, 16-gauge steel being suitable. The dimensions are given in the illustrations. All the steps are curved inwards as shown in the detail sketch, to keep them from projecting beyond the valances, as in full size. The actual treads can be made from bits of angle bent up from the self-material, and either riveted or brazed on. The steps require a stiffening rib on the back; this is merely a piece of 16-gauge steel fitted edgewise to the back of the step, and brazed in position. On the full-size engines, stay-rods are used, but the wheeze shown, is easier, and renders the steps "self-contained." The upper part of the step is riveted to the valance, and the bent-over angle at the top is riveted to the underside of the running-board.

The complete assembly can then be placed in position, and secured by countersunk screws passing through clearing holes in the running-board, into tapped holes in the top of buffer- and drag-beams. Three ⅛-in. or 5-B.A. screws at each end would be plenty. The running-boards are supported intermediately by little brackets bent up from 16-gauge steel as shown in the detail sketch. These brackets can be attached to the frames, between the coupled wheels, by ⅛-in. screws; and countersunk screws, nutted underneath, can be used to hold down the running-boards to the brackets. Alternatively, the brackets can be riveted to the underside of the running-boards; just use whichever method you prefer. Doesn't matter much which way you go, as long as you get there!

Cabs

An outline showing the cab front of the "Maid of Kent," appeared along with the illustration of the footplate fittings; and as the dimensions were included, there is no need to go over the same ground again. The cab front for the "Minx" is shown in the accompanying sketch, which gives the details. It can be made from 16-gauge or 18-gauge steel, and is simpler than the "Maid's" cab front. A good tip for beginners is to cut out and fit a dummy cab front in thin cardboard. It doesn't matter a bean if you spoil half a dozen or so; the only material loss is your time. When you get one O.K., nicely to outline, and fitting closely to the firebox wrapper, use it as a pattern from which to mark out and cut the sheet-metal one. Cardboard is cheaper than steel, and much easier to cut! The windows are just plain holes 1½ in. diameter, but they should be "glazed" as mentioned previously, using mica or cellophane, with brass frames riveted on by aid of bits of domestic pins, or else attached by 12-B.A. screws.

The cab sides are also cut from 16- or 18-gauge steel, to the dimensions given in the drawings. The sides for the "Minx" are simple in the extreme, but the "Maid's" are a bit more tricky, having a step at the bottom to match the running-

boards, and side windows. Here again, beginners will find it a great advantage to cut out a cardboard template first, and so avoid wasting metal. If they have obtained the blueprints, in the full-size, as recommended earlier, the outline of the cab side could be transferred to the bit of cardboard by carbon tracing, as previously mentioned; the tracing cut a shade larger than the outline shown, and finally fitted to the actual engine, after which it is used as a guide to cut out the metal cabside. Leave a strip at the top of the "Minx's" cab side, about $\frac{3}{8}$ in. wide; bend this inwards to the same radius as the curve of the cab roof, which may be attached to it by screws and nuts. This saves having to rivet on separate pieces of angle. Angles will, however, be required to attach the cab side to the front; and pieces of angle will also be needed along the bottom edges, for attaching the cab side to the running-board. The side windows in the "Maid's" cab are cut out and "glazed" same as those in the cab front.

The beading around the openings in the sides of the cabs, out of which the driver leans to look for signals when he cannot see them through the cab windows, can be made from nickel-bronze strip (the stuff we used to call German silver) $\frac{1}{4}$ in. wide, and about 18-gauge thick. Mention of looking out of the side, reminds me of one particularly rough winter's night on old 432, a Stroudley "C" class goods engine. We were bound for Hastings; it was blowing half a gale and snowing a blizzard. When the old girl pushed her smokebox out on to Ouse Viaduct, thoughts of the Tay Bridge disaster went straight through my mind, and I fervently hoped I shouldn't finish among the bits of locomotive and sixty wagons in the valley below! We couldn't see the blessed signals at the south end of the viaduct for toffee-apples, the snow had blocked up the cab windows, and it was a case of leaning out, and trying to keep the snow out of our eyes. The engine didn't mind a bit, she plodded steadily over the long string of stone arches, blowing off gently, defying the wild elements with her steady even beats; but it seemed an eternity before we spotted the welcome emerald speck through the whirling snowflakes, and gained a little more sheltered piece of line.

The beading may be silver-soldered in position if you like to take the trouble; or, as long as it fits closely to the edge of the opening, ordinary soft-soldering would do. There is no strain on it, and the handrail pillar holds it in position. On the full-sized engines, the handrail pillars are forged and turned; they are of two different diameters, and the nut in the middle, clamps the beading against a collar formed on the lower section. We needn't go to all that trouble! The lower part can be formed by a piece of $\frac{3}{16}$-in. round steel, with a collar brazed or screwed on at each end. The rod projects through the bottom one, and fits into a hole drilled in the running-board. The upper collar is screwed on to the rod, and furnished with a nut, the screwed part going through a hole in the beading, same as in full size. The end of the rod is drilled and tapped to take the extension, which is made of $\frac{1}{8}$-in. rod. The detail illustration explains the whole doings. The topmost collar can be soldered to the beading, on the "Maid"; on the "Minx," make the collar a sliding fit on the rod and solder it to the underside of the cab roof. If the roof is removed at any time, the collar comes away with it and leaves the top of the pillar free.

The cab roof of the "Minx" is simply a piece of 16- or 18-gauge sheet-metal bent or rolled to suit the curve of the cab front, and attached to the bent-over upper edge of the cab by $\frac{1}{8}$-in. or 5-B.A. countersunk screws and nuts. A band of $\frac{1}{8}$-in. by $\frac{1}{16}$-in. strip is fixed across the centre, and secured by small rivets, or solder, just as you prefer; whilst the rear end is finished off with a piece of $\frac{3}{16}$-in. by 18-gauge angle, fixed in the same way.

Whilst the cab roof of the "Maid" can be finished off in similar fashion, will look all right, and be quite serviceable, it can, of course, be arranged similar to the full-size "L1's," as shown in the illustration. In that case, the upper edges of the cab side are not bent inwards, but cut to a straight line just above the windows, a butt strip being riveted to the inside, projecting upwards about $\frac{3}{8}$ in. above the edge. The top of the cab is bent to a fairly sharp radius each side (see upper edge of the cab front shown along with the footplate fittings in a recent issue) and comes down flush with the upper edge of the cab, when the roof is in position. A few countersunk screws and nuts through the edge of the roof, and the butt strip, holds the whole issue in place, and allows for easy removal any time if necessity arises. The rain strip, is made from $\frac{3}{16}$-in. by 18-gauge angle. The cabs are attached to the running-boards by screws through the angles at the bottom.

The L.S.W.R. "Greyhounds"

MR. F. C. HAMBLETON'S article in the "M.E." for November 4th, 1948, revived a cherished memory for me; for the first engine of this class, No. 702, was the one which gave me the first 80 m.p.h. that I timed myself. It was in the summer of 1912, and I was on my way to Eastleigh. I had chosen a train which was booked non-stop from Waterloo to Eastleigh, and I fancy it was a relief-train to one of the more important Bournemouth expresses. It was made up of no fewer than fifteen bogie coaches, crowded with passengers and luggage, and must have meant a load of at least 450 tons for No. 702 to tackle single-handed. She struggled with it nobly to Basingstoke and on to Battledown summit. But she had taken 68 minutes for the first 50 miles and was running about 10 minutes late at that point.

However, down through Mitcheldever, Winchester and Shawford, No. 702 just went like the wind. Approaching Winchester and on towards Shawford, I counted no fewer than 32 mileposts in the remarkable time of 6 min. 3 sec., representing an *average* speed of 79.9 m.p.h. for those 8 miles. What the precise maximum speed was, I do not know; but it must have been about 85 m.p.h. No. 702 has always been one of my "pet" engines.—J.N.M.

Building a Model Naval Gun

by F. Surgey

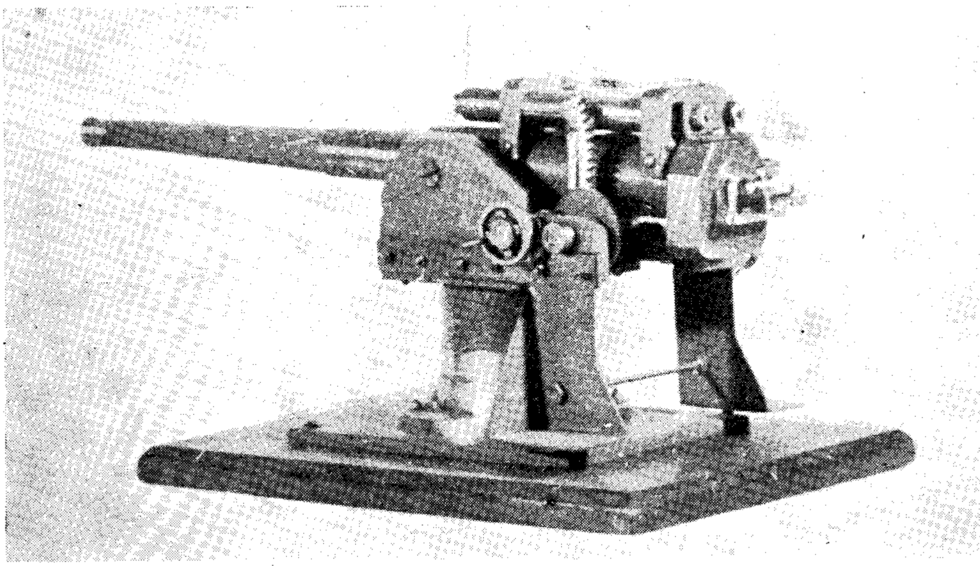
HAVING built, during the war, a number of models suitable for wartime exhibitions, I had by 1941 quite a collection. These included a model of H.M.S. *Ajax* together with a model 3.7 in. A.A. gun, both described in the March, 20th 1941, issue of THE MODEL ENGINEER. In addition to these, I constructed two more warships, H.M.S. *Newcastle* and H.M.S. *Cossack*, both free-lance and approximately 3 ft. in length.

I was looking for further wartime subjects for exhibition purposes, and while I was perusing some copies of *Picture Post* and *Illustrated*, I collected several good illustrated articles on the "Rearming of Merchant Ships" I put these pictures together and from them I devised the design for the naval gun. The drawing was evolved round the size of the barrel, as I already had a length of steel bored through the centre. The model is quite simple, and would make a very interesting attempt for an enthusiast who possesses a lathe of 3-in. centres or thereabouts.

Readers may note there is a slight difference between the photograph and drawing, this being mainly for the traversing and elevating gear which I have redesigned for smoother operation.

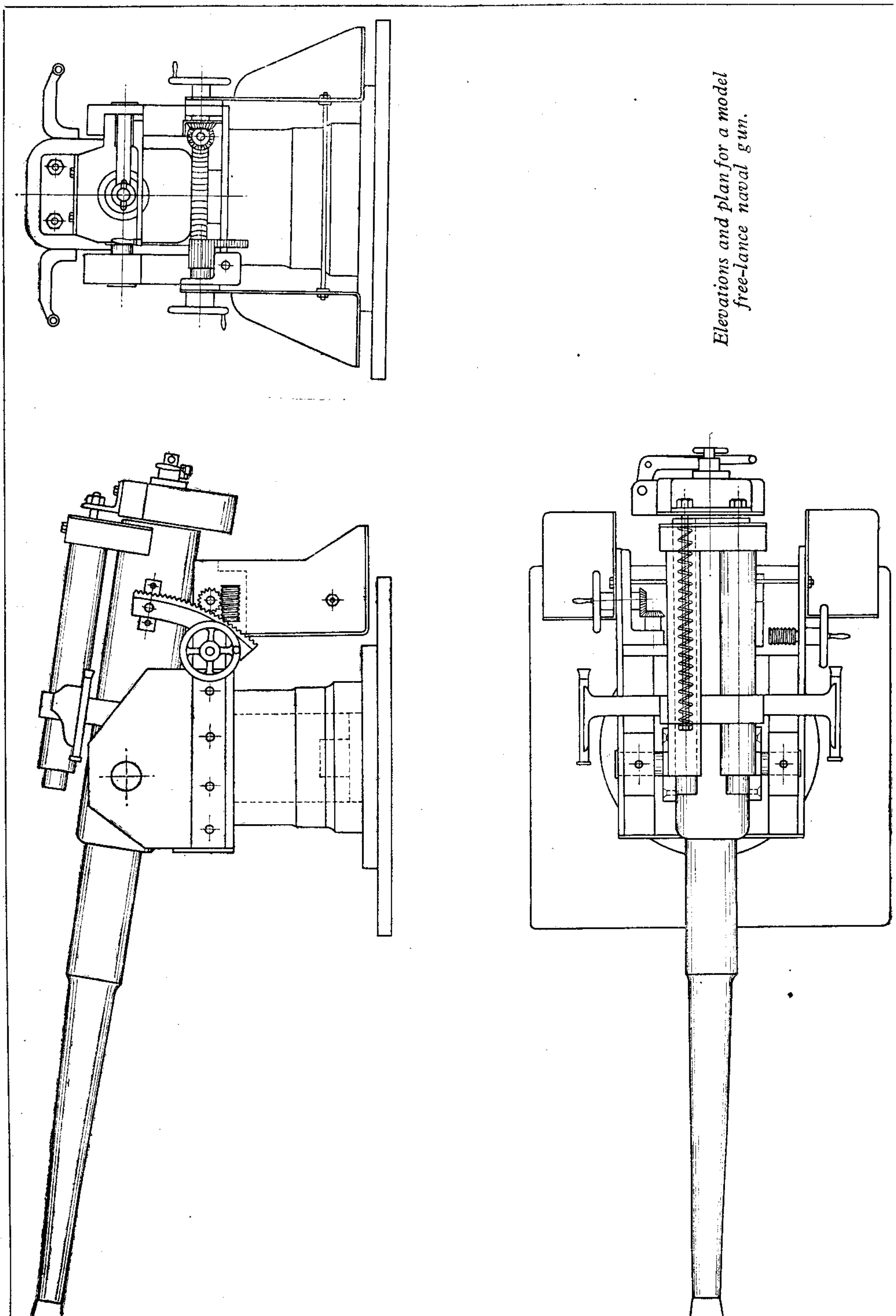
The first job was to machine the barrel to a diameter of $\frac{3}{4}$ in. to become a sliding fit in the barrel tube. It was then taper turned and reduced at the tip to fit a small brass cap which was later turned and forced on up to a shoulder. The breech end was next turned down ready for the breech block, and small brass brackets were cut to shape and studded to the barrel tube, one on either side to take the pivot pins.

The baseplate was next cut and drilled for bolting to the "deck" or baseboard. This plate is also drilled for bolts to secure the $3\frac{1}{8}$ in. diameter brass plate which was later turned and bolted to the baseplate. This brass plate is fitted with a boss which secured the shaft around which the gun revolves. The boss may be machined separately and bolted to the brass plate, or it may be turned integral with it, depending on the material available Above the plate is a machined bush of $1\frac{1}{4}$ in. bore and $1\frac{3}{4}$ in. long, the largest diameter outside being $2\frac{1}{8}$ in. and the smaller $1\frac{7}{8}$ in. The bush revolves with the gun and gives a rigid appearance if a flange is turned on the circular brass plate.



The trunnion bearing plates were next cut from $\frac{7}{16}$ in. thick brass and drilled for bolts and pivot pins which are $\frac{5}{16}$ in. diameter. These bearing plates were bolted to a $2\frac{1}{2}$ in. square plate $\frac{1}{8}$ in. thick, although not before the bearing plate at one side was cut away to fit the traversing work, as the gear with which it meshes is rather large. The whole gun trunnion was studded to the $1\frac{1}{4}$ in. bore bush so as to form one unit.

The breech block was cut from a piece of $\frac{1}{2}$ in. thick brass with a hacksaw, providing two lugs for the hinge of the breech and handle. The block was bored to drive on to the end of the barrel previously machined. When this was done, the whole barrel was assembled and fitted by the



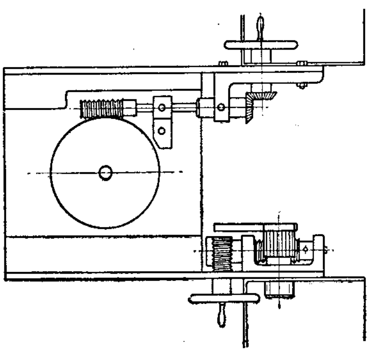
Elevations and plan for a model free-lance naval gun.

pivot pins to the trunnions, these pins being later secured by a 6-B.A. stud to prevent them moving when the gun was finally assembled.

So far the construction had been very simple, and I did not come across any snags.

The gun was then taken apart, and $\frac{1}{8}$ in. thick steel bars 4 in. long and $\frac{7}{16}$ in. wide were cut and polished. These were drilled to bolt at the base of the trunnion bearings, and were also drilled for bearings and the plates on which the crew stand to operate the gun. The bearings were cut from brass and designed to suit existing gears, while the plates previously mentioned were cut from $\frac{1}{16}$ in. sheet steel. These two plates are strengthened by a bar between, then screwed at either end to take 6-B.A. nuts.

The barrel was once more set up in the lathe to be bored for what I call the breech nut. Both the breech and nut were cut from a brass Whitworth bolt and nut, the hexagon being turned off the nut to fit into the recess bored in the barrel



Detail of elevating and traversing mechanisms

The bolt was turned down to a diameter of $\frac{1}{8}$ in. to fit a hole drilled in the breech arm. Threads were filed into four sections so that the breech would push straight into the block and secure itself when turned $\frac{1}{8}$ th of a revolution. A small handle was made and soldered to the projecting $\frac{1}{8}$ in. diameter portion of breech to turn it with, while steel pins were driven into the bracket arm which holds the breech, to prevent it turning too far. The bracket arm was cut from brass and drilled to take the hinge pin. Another longer arm with small brass handle soldered to it was fitted to the breech bracket arm to swing this open.

To the side of the barrel tube was mounted a section of gear, cut from an old heavy brass clock wheel. This was fastened by means of brackets soldered and studded to the tube and gear section. It was so arranged to mesh with the elevating gears (which as shown in the drawing is different from the photograph). The gears were odd ones I had in stock, and bearings for same were cut from brass and bolted to the gun frame. The disadvantage of my early arrangement of gears was that the ratio was too small a reduction, and a very few turns of the handle sent the barrel from level to maximum elevation height, which you will see is not very high in this type of gun. The drawing shows a better arrangement, and gives, with the two sets of worms, a considerable reduction.

Small hand-wheels were turned from $\frac{7}{8}$ in. diameter brass and were cut and drilled for spokes, while later fitted with small steel handles driven into the rims.

The traversing mechanism was next fitted and the bracket bearings cut from brass. The gear which meshes with the worm is studded to the top of the main centre shaft around which the gun revolves. At the opposite end to the gear the shaft fits into the collar or boss, which is in turn fixed to the base as previously mentioned. This shaft and gear, being stationary, allows the worm to work round it, so turning the gun.

Attention was now directed to the recoil chambers which are mounted on the top of the barrel tube by means of brackets. These brackets were cut from brass or steel and drilled for tubes. They were then studded to the barrel tube with 6-B.A. bolts. The tubes of $\frac{1}{4}$ in. bore were next turned and polished, being plugged solid at the forward end. These tubes were then studded tightly into the brackets. To give the correct impression of recoil, the tubes were fitted with internal springs, and through these springs passes a rod screwed at both ends. The end inside the tube is fitted with a nut or collar which presses against the spring and compresses it when the barrel is slid backwards; the opposite end of rod is screwed into a piece of $\frac{1}{2}$ in. $\times$ $\frac{1}{2}$ in. angle and fitted with a lock-nut. This angle is in turn bolted to the top of the breech. A plate must be fitted over the open ends of the tubes and studded to the rear tube bracket to hold the other end of the spring in position.

Should the reader wish to make the gun fire, a barrel of the precise bore must be fitted and a firing mechanism incorporated similar to the one described by Mr. Walter in his article "Model Quick Firing Naval Gun" in THE MODEL ENGINEER dated January 7th, 1944. The model was now almost completed and there remained only the fitting of sights, which appeared from photographs to be of the simple telescopic type. They were turned from brass and fitted on either side of barrel by means of brass brackets.

The final job was painting, so the gun was once again taken asunder, and parts of the barrel, breech, recoil chambers and handles, together with the brass baseplate, were polished. The remainder of the gun was painted silver grey, and the reassembled unit finally mounted on a polished wood base. It has been on show at many exhibitions, together with the other models of my collection.

Welding Repairs

Messrs. Barimar Ltd. of Barimar House, 22/24, Peterborough Road, Fulham, S.W.6 have recently issued an illustrated booklet describing how welding methods can be applied to the repair of all kinds of machinery. The illustrations in the book are taken from actual examples of repairs effected by Barimar showing the components before and after repair, and they demonstrate how parts, apparently beyond repair, can be restored to service at comparatively low cost by the methods described.

*TWIN SISTERS

by J. I. Austen-Walton

Two 5-in. gauge locomotives, exactly alike externally, but very different internally

THE method of assembly of the frames is one on which it will be necessary to dwell at some length. Let it be accepted from the start that the frames will have to be dismantled quite a number of times before completion—not just for the fun of doing so, but to facilitate the correct fitting of all the bits and pieces that are fixed inside and outside. I have placed considerable emphasis on the most careful reproduction of the prototype, and I want all the details—seen and unseen—to be correctly made, quite regardless of the work involved.

Reference to the frames drawing, showing the plate stretchers and diaphragms, gives also a number of drillings to take these parts. They would normally be rivets and, in a few cases, bolts. If the frames were to be riveted up in all those places, dismantling would be impossible. I have made my frames and platework with just one 7-B.A. service-bolt through each corner of the plate fittings inside the bolted-up assembly. It forms a rigid and strong unit, even without any buffer-planks in position. This means that, by removing about a dozen nuts, one side of the frames can be removed. I shall drill all the holes shown, putting dummy rivets in where actual fixings are not required. There are cases where the rivets come through the frames and are countersunk in them. In such cases, I advocate fitting the dummy rivet heads inside and not drilling through the frames at all. There is not much point in having a dummy flush rivet on the outside of the frame as, after painting, it could scarcely be seen. The fitting of dummy snap-head rivets is not difficult. Drill the hole as for normal riveting and slightly countersink the hole at the back of the frame. Soft rivets such as dural or aluminium are easy to burr over slightly into this sink and the job of filing off flush with the flange is a matter of seconds.

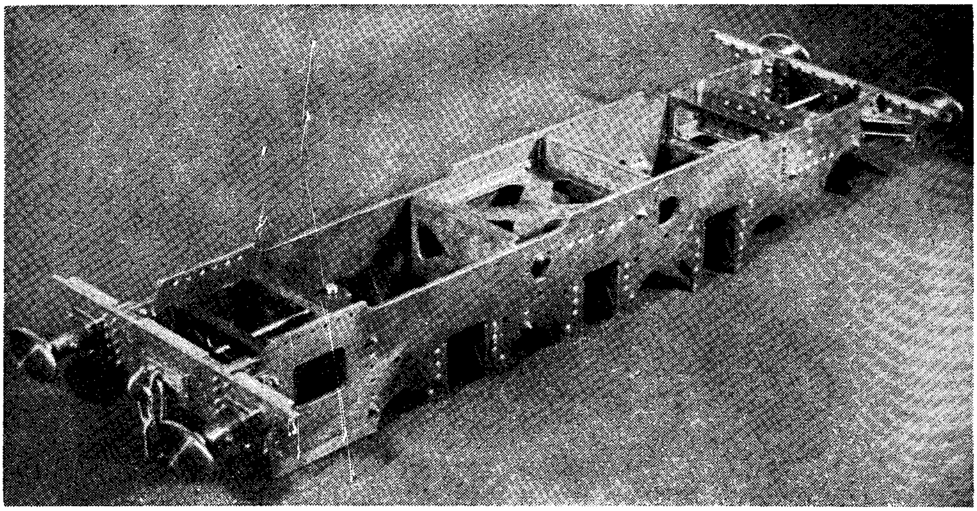


Photo by] [*A. Duncan*

The first frames assembly

The sheet-metal parts already described are not the complete story, and while we have the bending blocks and sheet steel to hand, it will be worth while making the remaining brackets and putting those not immediately required to one side. There is no doubt that once one has got into the sheet-metal way of working, with all the odds and ends of tools for this class of work at hand, it is far easier to continue with whatever parts call for such a frame of mind and such technique.

On page 456 are shown sketches of two pairs of such brackets that will be bolted to the outside of the frames to support the running-boards. These need not be drilled yet, but ultimately they will pick up with two existing rows of holes in the frames opposite and in line with two inside existing members. So give your service-bolts a little spare length to embrace the additional thickness of metal. The two brackets with drillings shown, and a small bridge to go between

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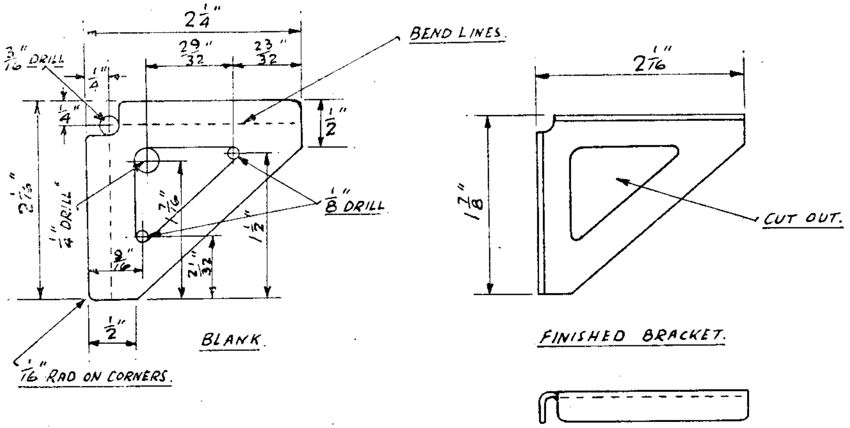
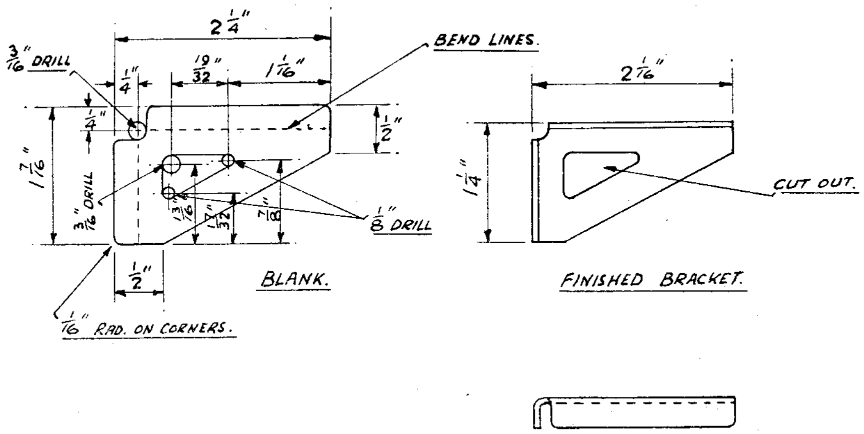
**Continued from page* 326 "*M.E.*" *March* 17, 1949.

them, can be made and used straight away. They are partly bolted and riveted to the underside of the rear diaphragm as shown, and will carry the bearings for the cross-shaft actuating the brakes. If you are building "Minor" without steam brakes, you might like to reconsider the whole 5/32 in. or $\frac{3}{16}$ in. thick. They are attached to the frames by small angles running vertically inside, whilst the outside extremities of the beams are supported back on to the frames by means of sheet-metal gussets. This is still another item for the sheet-metal department and can be made



RUNNING BOARD BRACKET (REAR).

1 OFF. EACH HAND. IN 16.G. STEEL.



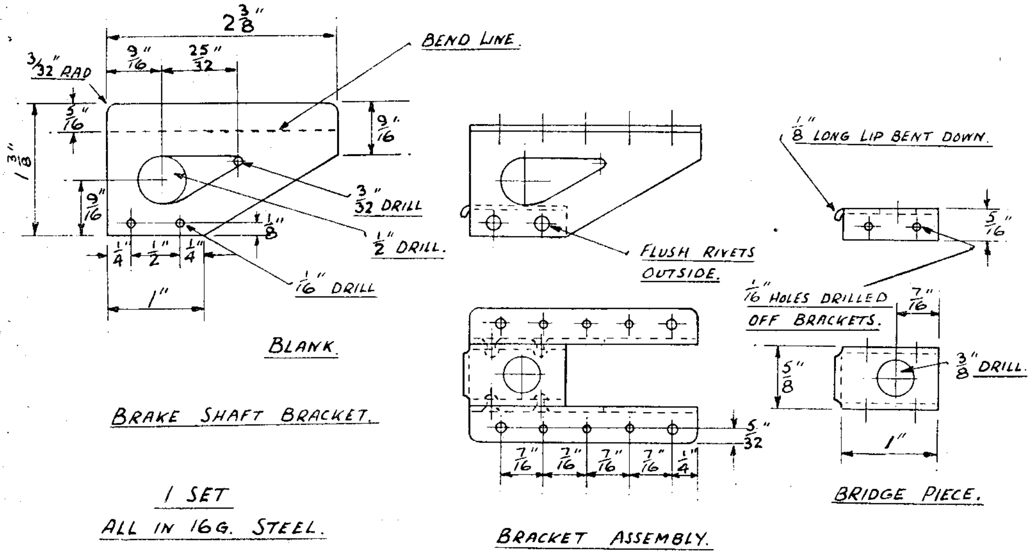
RUNNING BOARD BRACKET. (FRONT).

1 OFF. EACH HAND. IN 16G. STEEL.

question of brakes, fitting the hangers and shoes as for "Major" and utilising the system for the sake of the hand-brake, which is of the vertical-screw type and employs the same shaft. This means only the elimination of the brake cylinder and valve. If you do not intend to fit brakes in any form at all, then don't fit the brackets, which would look rather empty and pointless without the shaft below.

The next big job is to make and fit the buffer planks. Again, reference to the drawing will show these made in plain strip $1\frac{1}{2}$ in. wide by up even before the beams themselves, but will not be fitted until the actual buffers and stocks are made.

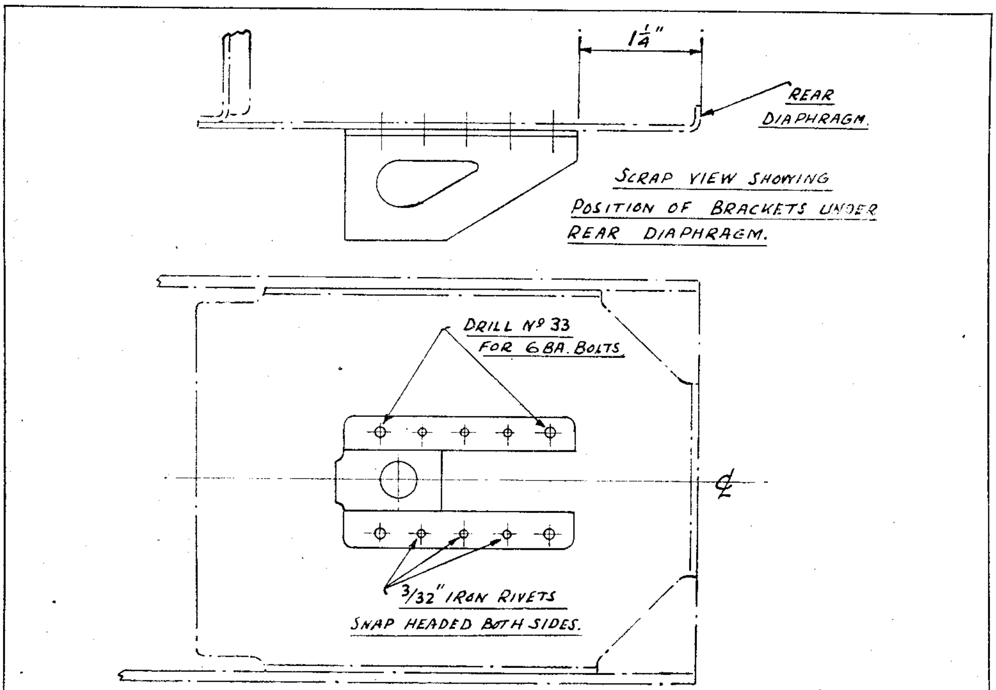
To make the planks, cut out two pieces of steel to the same length and profile, with the centre slot and $\frac{3}{16}$-in. centre holes for the buffer stocks in the same position. Mark out all the drilled holes and note that the two vertical rows of 8-B.A. tapped holes are in the front beam only. These holes can be relieved with a clearing drill for about half the thickness of the metal as the tiny 8-B.A. hexagon bolts are dummies only,

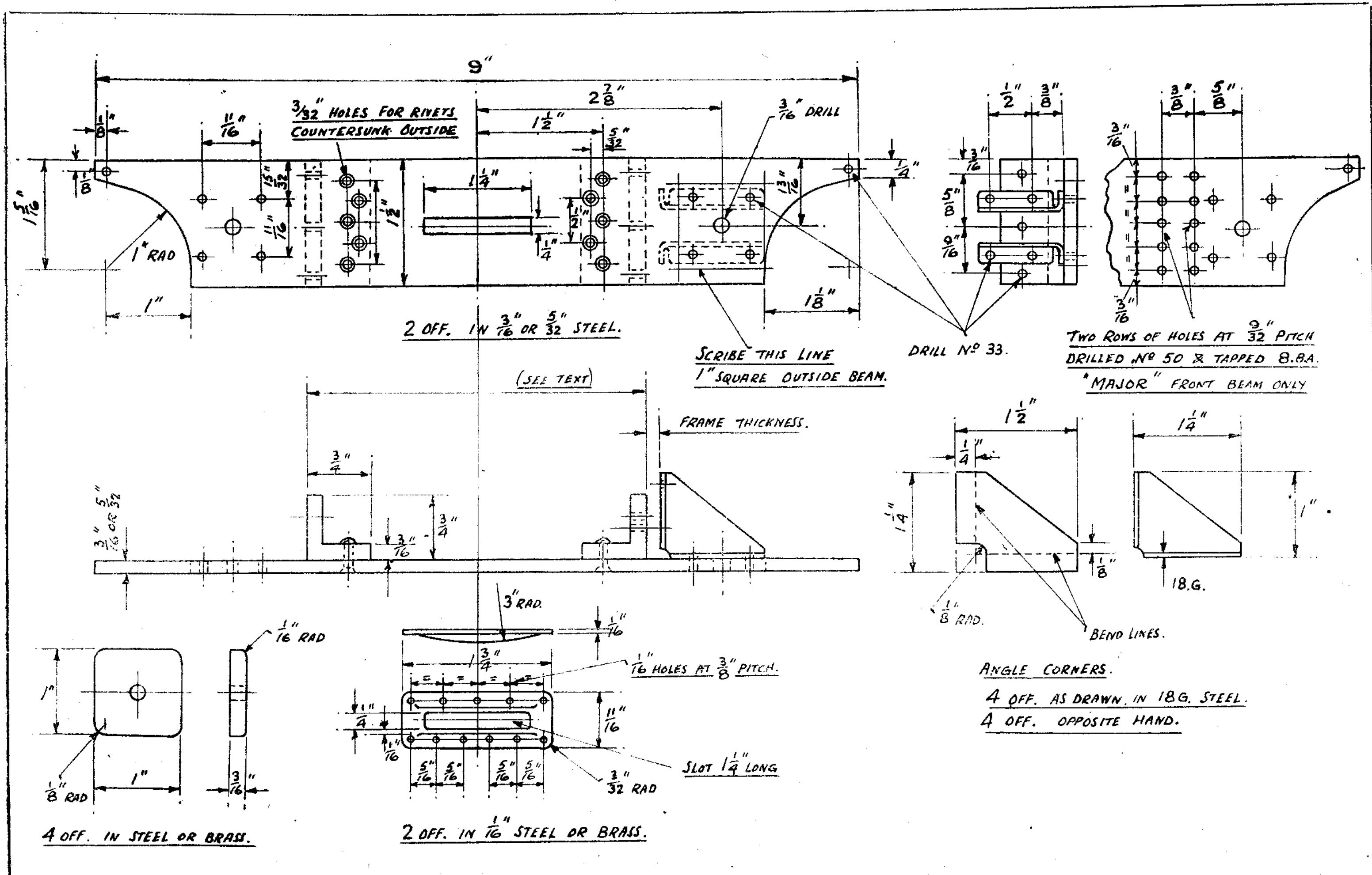


simulating the actual plank fixings on the prototype. Clear these holes from the front face of the plank to assist the bolt-heads to sit flush on the plank face. When fitted, any projection of the back face of the plank can be filed flush. Fortunately, these bolts can be left in position for good. The real fixing-angles can be drilled and fitted to the plank first with service-bolts.

When the plank has been offered up to the frames and the angles adjusted to give a comfortable fit between the frame faces, they can be number-stamped or marked along the top edges, and taken off.

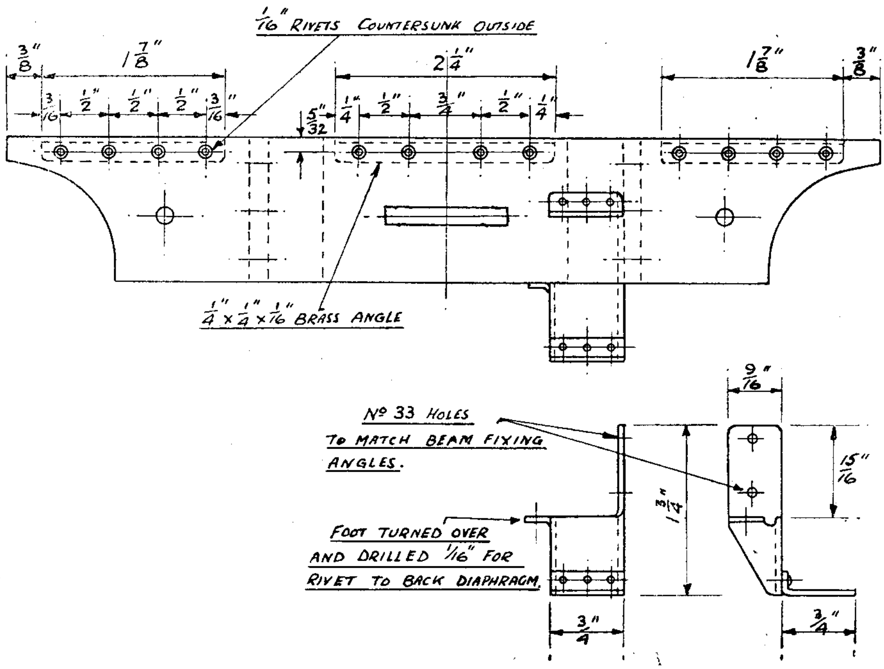
By dropping off one side of the frames at a time, the angle cleats can be clamped to the frame ends one by one, and the drilling continued through for the fitting of more service-bolts. When this operation is complete, the angles may




3/32" HOLES FOR RIVETS COUNTERSUNK OUTSIDE
3/16" DRILL
2 OFF. IN 3/16" OR 5/32" STEEL.
SCRIBE THIS LINE 1" SQUARE OUTSIDE BEAM.
DRILL Nº 33.
TWO ROWS OF HOLES AT 9/32" PITCH DRILLED Nº 50 & TAPPED 8.B.A.
"MAJOR" FRONT BEAM ONLY
(SEE TEXT)
FRAME THICKNESS.
1" RAD
3" RAD.
1/16" HOLES AT 3/8" PITCH.
SLOT 1 1/4" LONG
3/32" RAD
1/8" RAD
1/16" RAD
18.G.
BEND LINES.
ANGLE CORNERS.
4 OFF. AS DRAWN. IN 18G. STEEL.
4 OFF. OPPOSITE HAND.
4 OFF. IN STEEL OR BRASS.
2 OFF. IN 1/16" STEEL OR BRASS.

be riveted with iron rivets to the planks, flush on the outside of the plank and snap-headed on the inside of the angle. The assemblies should again be offered up to the frames and bolted up.

Now take your first check on frame alignment, setting the entire chassis edge down on some flat all twist and bend has been removed as previously advised. Take the sheet-metal stretchers and diaphragms and study the drawing carefully to see that top and bottom flanges look the right way for offering up. With this in mind, rivet the two brackets on to No. 2 stretcher. Fix the centre



View showing back beam and step as seen from behind the engine. Brass angles are on both front and rear beams, fitted inside for footplate fixing

surface like a sheet of plate-glass, or the marble top of an old washstand. By way of a warning, although plate-glass is normally quite flat in itself, unless it is evenly supported and itself resting on a flat surface, it is easily distorted, even by its own weight. I use a thick, flat wooden base, with a sheet of sponge rubber on top. The plate-glass rests on this and is well supported. If your test reveals twisting and warping, loosen off all the service-bolts to let the frame edges relax on to the prepared surface. By re-tightening one bolt at a time and re-checking at each tightening, you should be able to note which component is pulling the assembly out of line. Taking out the offending member is an easy job, and a file should correct any slight mistake. Here you see the value of making sure that the original bending plate was quite square. Apart from such early mistakes, it may happen that the drilling through the frames on to the inside components was done with the frames incorrectly held. To those who have not yet tackled this first job, here are my suggestions.

Take one frame side only, and make sure that diaphragm to the Nos. 3 and 4 stretchers, using service-bolts if required, and check the sub-assembly by laying the three joined parts on the inside face of the frame. This will reveal any tendency for the diaphragm to run "up hill" one way or the other, or for the stretcher flanges to stick up or below the frame line. Once this has been checked, the three parts can be finally riveted together. Taking the same precautions, assemble the Nos. 5 and 6 stretchers to the rear diaphragm. At this stage the vertical stretchers may slope backwards or forwards due to the strain of riveting, but they can be bent to correct them for line, and the mating flange of the diaphragm will do the bending without visible distortion.

Clamp each part in turn, using toolmakers' clamps, to the measured position on the frame face, and when so held, drill through from the existing row of holes in the frame. One hole at each embracing end of the row should do for now and the service-bolts can be put in.

When all the components are fitted in this manner, lay the frame on its top edge on a large flat surface as described, and bring the other

frame plate up to the side of the assembly. Fix this side to the stretcher with clamps and see that the bottom contact edges of the frames resting on the flat surface are still in good contact, and that there is no rock anywhere.

By drilling one hole at a time and bolting up after each drilling, you should be able to secure a frame assembly that is perfectly true in every respect.

The fitting of the buffer-planks should not disturb this truth of alignment, but if it does, you then know where to look for the fault.

We will take it that the final test shows the chassis all fair and square, not forgetting that the plank itself must be square with the sides of the frames.

The rest of the buffer-plank furniture comprises the packing pads to go behind the stocks, the buffers and stocks, and the central guide-yoke for the draw-hook, forgetting for the moment the single-step plate that adorns the rear beam only. The packing pads are simple enough, but some care should be taken to set out quite accurately the four holes in the corner of the pads. If you like, you can drill the centre $\frac{3}{16}$-in. hole in all four pads and mark out the other four holes at $\frac{11}{16}$ in. centres both ways on one pad only. You may then use this as a jig to drill the other three pads, holding them together with a $\frac{3}{16}$-in. or 2-B.A. bolt. For accurate results, drill only one at a time, using the first pad only as the jig.

Mark or Number

When finished, mark or number them to correspond with the markings already made on the beam. In the same way, the four pads may be bolted temporarily to the plank face, and, after seeing that they are quite square, the four corner holes may be drilled through the plank. Use a No. 33 drill, which is a generous clearing size for 6-B.A. bolts. The normal 6-B.A. head size is too clumsy to sit comfortably in the corner of the buffer stock and I make and use 6-B.A. bolts with 8-B.A. heads. The nuts to go on can be the standard size. In any case, the practice of lifting the locomotive on and off the track by means of the buffers is quite a common one and involves quite a considerable strain on the bolts. For that reason, I use either stainless steel, which is normally about 60 to 65 tons tensile, or bolts made from some high-tensile material. Pieces of the commercial high-tensile bolt do the job very well, and are easy to get.

Casting or Built-up

The central yoke for the draw-hook could be prepared in the form of a small casting, but, unless carefully cast, might be clumsy. It is almost as easy to make up these two items from $\frac{1}{16}$-in. brass sheet, silver-soldering the two curved lips into the slot. If you do this, make the slot in the backplate wider by twice the thickness of the material for the lips, and make the l p blanks to stick out behind the plate whilst soldering up. You can then clamp the projecting back edges together on a small piece of $\frac{1}{4}$ in. packing until the operation is over, and then saw and file off the pieces not required. The rest of the drilling to drawing is easy, and even $\frac{1}{16}$-in. copper rivets would do for attachment to the plank, with the inside heads of the rivets either snapped over or finished flush. In any case, they can go on for keeps.

(To be continued)

A Universal Swivelling Vice

(*Continued from page* 437)

plane of tilting movement, besides enabling the ball to be made solid with the base of the vice. The two halves of the socket are drawn together by a cross bolt placed as close as possible below the ball, and as the actual range of movement of the members required in tightening or relaxing their grip is microscopic, it is not necessary to articulate them relatively to each other at their lower end. Stop screws are, however, provided here to prevent them closing in under clamping pressure, and these are set so that the gap between the parts is parallel, and the base surface of the flanges flat, before mounting the vice on the bench.

A Short Mount

An important feature of this form of mounting is that the gap between the halves is widened out sufficiently to allow the neck of the ball to pass between them, and this enables the vice to be tilted to a considerable angle in the plane of the gap. In the interests of compactness, the mount is kept short so that the maximum angle of tilt is less than a right angle, but it could be increased by raising the mount another $\frac{1}{2}$ in. above the base flange. The angle of tilt of the vice, in other positions than in the gap, is a full 30 deg., which is about the same as that of most other types of ball-socket mountings.

Various Mountings

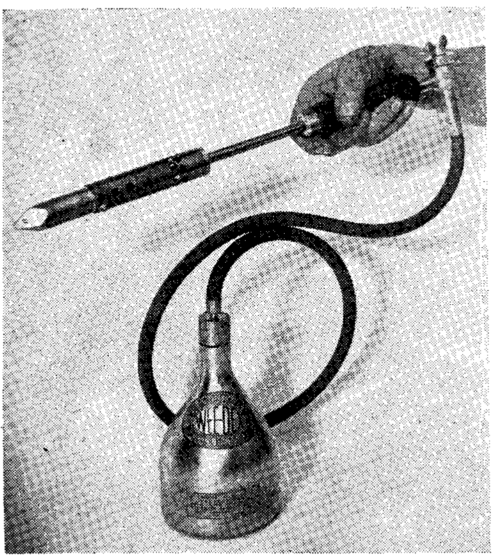
Some readers may prefer to use a vice of this type, not as a permanent bench fitting, but temporarily held in a larger vice, and if so, a modified form of ball socket mount may be fitted, without the clamp screw, but adapted to grip between the jaws of such a vice. Similarly, the mounting may be adapted for use on a machine tool table, though a vice of this type is inherently inferior in rigidity to the normal form of swivelling machine vice. It is also practicable to fit the vice on a plain cylindrical stalk, so that it swivels only about a vertical axis, if this should be preferred.

It is proposed to describe the machining of the components in detail, giving appropriate hints on possible modifications in design or methods of procedure. Castings of this vice may be obtained from Mr. W. H. Haselgove, 1, Queensway, Petts Wood, Kent.

(To be continued)

A Portable Gas Blowlamp

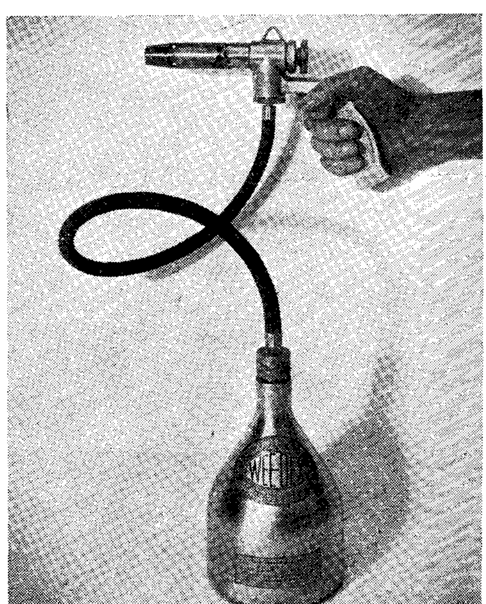
UP to the present, practically all blowlamps have been designed to burn liquid fuel, for the simple reason that this was the only kind of fuel which could be utilised in an appliance which must be capable of application in any location. Nearly all liquid fuels, however, have certain disadvantages in use, particularly in respect of the need for vaporising them in order to produce a clean flame of sufficiently high intensity. While vaporising burners work very efficiently when in perfect condition, they almost invariably give trouble sooner or later by internal carbon formation which causes choking of jet nipples and fouling of vapour tubes, reducing their heat conductivity and thereby causing imperfect vaporisation.



Of recent years, the development of portable gas appliances using dissolved or liquified gases has made it unnecessary to rely on liquid fuel for cooking and heating purposes in caravans and cruisers, and the same principles have now been extended to blowlamps by the provision of a suitable form of gas container, which takes the place of the normal liquid fuel reservoir. The liquefied gas does not require a vaporiser, as it assumes the gaseous form immediately on release of pressure and can, therefore, be used in a burner which is essentially similar in principle though not in actual design, to an ordinary gas bunsen-burner. It is equipped with a regulating valve, and may be used either directly attached to the gas container, or on a flexible extension tube. The gas container is equipped with a self-sealing valve so that no gas escapes when it is detached from the burner, and no tools are required for assembly or detachment of the container or other parts which need to be dis-

mounted in service or general maintenance. The heat attainable by this form of blowlamp is equal to that of the most powerful liquid fuel blowlamp of comparable size, and internal fouling of the burner cannot occur. A single charge of gas will serve for several hours working at full intensity, and the container can be recharged at moderate cost. A self-heating soldering bit for use with the same type of gas container is in course of development, and will be interchangeable with the blowlamp burner.

This device, known as the "Wee-Dex" blowlamp, is manufactured by Dex Industries Ltd., Wee-Dex Works, Edwin Road, Twickenham, Middlesex.



PRACTICAL LETTERS

Utility Steam Engines

DEAR SIR,—May I be permitted to express my appreciation of Mr. Westbury's series of very excellent articles on steam engine design.

I feel, and I'm sure others do too, that they fill a long felt want.

Like many other people, I had thought Mr. Westbury purely a petrol and diesel man, but it is very evident he has nothing to learn in steam design, and I for one have keenly followed his articles. I sometimes feel that the modern tendency of engineering journals is inclined a little too much to the study of high efficiency, etc., and involves the layman in so much highly technical data, through which he either struggles with gritted teeth, or throws aside in disgust.

It is very gratifying to me, therefore, as a lover of steam, to get down to hard facts again, as it were, in reading Mr. Westbury's articles.

Yours faithfully,

Glasgow. R. JOHNSTON.

The Story of an Oil Tank

DEAR SIR,—R. J. Frost writes a very interesting article on the above subject in your—or our—wonderful magazine.

He is, however, under a misapprehension when he states that his method is not suitable for normal production. Thousands of certain aircraft instruments were shielded by copper shields in this manner, as no other way was found possible either here, in Canada, or the U.S.A. It is, I believe, a Canadian idea, but instead of using lead as the filler, Wood's metal was generally preferred. We had to house a set of tubes and concomitant heating wires. After assembly, the spaces were filled in with Wood's metal, moulded to shape (the temperature was only that of boiling water), and then copper plated. I can commend it to anyone wanting moulds of intricate shape.

Yours faithfully,

Bristol. R. GOUGH.

DEAR SIR,—Mr. R. J. Frosts' article in the March 17th. issue of THE MODEL ENGINEER, brings back memories of the Beardmore aero engine of the 1914-18 war. If my memory does not fail me, this engine had its water cooling jacket formed in a similar way. The iron cylinders had the water space cast on in lead, which was then electro-plated with copper; when sufficient copper had been deposited the lead was melted out, leaving a water space. It seems to me that this would be an ideal way of forming water jackets on the small model water-cooled engines.

Some readers may not be aware that wax, plaster, wood, etc., may also be copper-plated if the object is first coated with a conducting skin, and for this purpose metal powder or graphite can be used. In this way, models of small pressings may be copied, or the decorative brass work of fairground traction engines reproduced. The copper deposit is either peeled off afterward, or in the case of wax this can easily be melted out.

Worn parts can also be repaired by electrolosis, in some cases either copper or iron being built up.

Cleaning, descaling and polishing are now done by electrolitic processes.

No doubt Mr. Frost chose a straight copper sulphate solution because it is simple and safe; but it does not give a very smooth deposit, hence the reason he had to rub it down; there are a number of much more efficient baths that not only give a better deposit, but work much quicker.

Another point, if a very small jar was used for the plating I should have expected the thickness of the deposit to be very uneven, unless the object was turned at intervals to average out the throwing distance between the cathode and anode.

Yours faithfully,

Banstead. A. R. TURPIN.

Designing a Battery Charger

DEAR SIR,—I read Mr. R. E. Blakeney's excellent article with great interest, but I was sorry to see he had fallen into the error of switching from one meter to the other when calibrating the voltmeter (Fig. 6). This will lead to large errors unless the standard meter and the meter under test happen to take exactly the same current. The switch should be dispensed with and both meters connected in parallel to the battery and resistance (R)

A formula for calculating the optimum core area of the transformer may be of interest. It is $A = \sqrt{W}/5.58$ where W = volt/amperes output. From this it will be seen that the core area (i.e., the central hole in Fig. 1) should be about 1 sq. in. The formula for the number of primary turns can be simplified to $N = 1400/A$ for mains voltages from 230 V. to 250 V.

If enamelled wire is used for the primary winding, it is advisable to interleave the layers with thin waxed paper of 0.002 to 0.004 in. thickness. Old paper condensers are a useful source of supply.

I wonder if readers are aware that there is a right and a wrong way of connecting an ammeter and its shunt into a circuit? The shunt should be connected to the circuit, and the meter connected to the shunt. If the meter is connected to the circuit and the shunt connected to the meter, the resistance of the leads connecting the shunt to the meter will add to the effective resistance of the shunt, thus altering the meter deflection for a given current.

Turning to the Eureka Electric Clock, it occurs to me that the bearings used for the gyroscopes in aircraft bank and turn meters and similar instruments would be suitable for the pivot bearings. Alternatively, perhaps, the small ball-races to be found in a number of American aircraft instruments incorporating miniature 3-phase motors might be satisfactory.

Yours faithfully,

Topsham. A. M. TUCKER, Grad. I.P.R.E

Amateur Car Construction

DEAR SIR,—I was very interested in Mr. J. H. Ahern's letter in the issue of February 24th, THE MODEL ENGINEER, on small car design, and would very much like to see a series of articles giving instruction on building a small car. Would it not be possible to use an Austin 7 power unit, or one of similar h.p.? I am a motor mechanic, and on one occasion built an Austin 7 chassis, but was finally stuck with body trouble." As Mr. Ahern mentions in his letter, "there is not such a lot in a car when the frills are removed." I think that any reader of your journal could manage to recondition the necessary parts.

For simplicity, cheapness and the most essential safety, why not use existing car parts. It must be borne in mind that all mechanical vehicles have to be insured, therefore they must be safe in all respects.

I should like to see further letters on this subject, and I see no reason why any model engineer could not construct his own car, provided one of our contributors can design a two-seater body which can be constructed with the usual limited equipment.

Yours faithfully,

Worthing. P. ROFFE.

Oil Transmission for the "Minicar"

DEAR SIR,—I hope that anyone who thinks of adopting Mr. Skerry's proposal will find out how many satisfactory oil transmissions are functioning and how they are designed. About 25 years ago the L.G.O.C. had a bus chassis fitted with an oil gear which was wonderfully controllable, with instant reverse, etc., but it absorbed nearly 40 per cent. of the output of the engine. Oil reduction gears built for commercial use at the same time were not satisfactory for the same reason. The trouble appeared to be that if clearances in the pumps were not cut to the minimum, there was a loss through leakage, and if the clearances were reduced, seizures followed. The oil flow always seemed to form eddies with consequent heating.

In the early '30's one of the railway companies had the frame of an 0-6-0 locomotive fitted with a diesel engine and an oil transmission. To adapt the diesel was my part of the job and I warned the makers of the oil gear that inadequate oil coolers had been provided. However, I was told the gear had been thoroughly tried out. I believe that in the marshalling yard, with intermittent running, the locomotive would do 24 hours a day, and was quite satisfactory, but the oil gear overheated on a continuous pull. The diesel developed 375 b.h.p. at 750 r.p.m.

Dr. Hele Shaw was very interested in oil transmission and did much experimental work in connection with it.

Yours faithfully,

Ruardean. R. C. STEBBING.

CLUB ANNOUNCEMENTS

The Society of Model and Experimental Engineers

The result of the recent ballot held to ascertain the wishes of the members in regard to the proposed acquisition of new headquarters for the society was:—

For 183 votes.
Against 33 ,,

The Council will therefore continue with their negotiations for a lease of the premises at Wanless Road, Loughborough Junction.

The result of the ballot to decide on which days general meetings should be held was:—

For Saturday afternoons, 78 votes.
For week evenings, 41 votes.
For a combination of Saturdays and week evenings 95 votes.

The Council is, therefore, endeavouring to arrange the programme for the second half of the year in accordance with the ballot.

A stationary engine meeting will be held at St. Andrew's School, Windmill Street, on Saturday, April 23rd, at 3 p.m., and not at Nassau Street as previously advised.

Hon. Secretary: A. B. STORRAR, 67, Station Road, West Wickham, Kent. Springpark 3027.

Grimsby and District Society of Model and Experimental Engineers

The above society recently held an informal dinner at the Field House Hotel, Grimsby, at which members and their wives, and the judges who officiated at our last exhibition, were present. The president, Mr. W. H. Thickett, sketched the growth of the society from its inauguration in 1935, to the high position it holds today, and congratulated the members on the ever-increasing quality of workmanship apparent in their work. Captain Townend, one of the ship judges, proposed "The Society," to which Mr. Robinson responded, thanking the ladies for their tolerance and the help which they give in taking an interest in their husbands' hobby. Mrs. Tarttelin suitably responded. Entertainment was provided and a very enjoyable evening ensued. So much so, that it is now to become a regular annual event.

Hon. Secretary: J. TARTTELIN, 101, Ladysmith Road Grimsby.

Cambridge and District Model Engineering Society

The above society held their annual general meeting in February, which was well attended. All appreciated the committee's efforts to create more interest especially in the matter of films and talks which had been arranged and those fixed up for the future.

It was decided to hold another exhibition this year, prizes have already been given to encourage model making amongst the younger members.

The workshops have been well attended each Thursday, manned by two qualified members who supervise and give advice to all interested in model making. On March 7th an interesting talk was given by a representative from the Post Office Telephone Department on "Radio and Television Interference." This was supplemented by films and demonstrations and was much appreciated.

The May meeting has been booked for an interesting talk by an expert on boat building.

The prospects for 1949 look as if all previous records will be broken, so keep it up Cambridge, and set the pace for others to follow. Best wishes to all kindred societies.

Hon. Secretary: J. W. ATKIN, 16, Ross Street, Mill Road, Cambridge.

Handley Page Model Engineering Society

The fourth annual general meeting of the above society was held on March 16th and the secretary's report was one of steady progress. Improved facilities in the workshop included a hand shaper and bench shearing machine. The locomotive track was complete and in working order, but construction of the 5-in. gauge locomotive had not progressed very far. The car track had proved popular with our own and outside members.

The remainder of the evening was spent in seeing some interesting and instructive films on welding, workshop hints, lubrication and diesel engines. In addition a film was shown on gliding and soaring, produced by the Handley Page Gliding Club.

Hon. Secretary: H. W. CROOKS, c/o Handley Page Sports Club, Cricklewood, N.W.2.